Pay Line Group

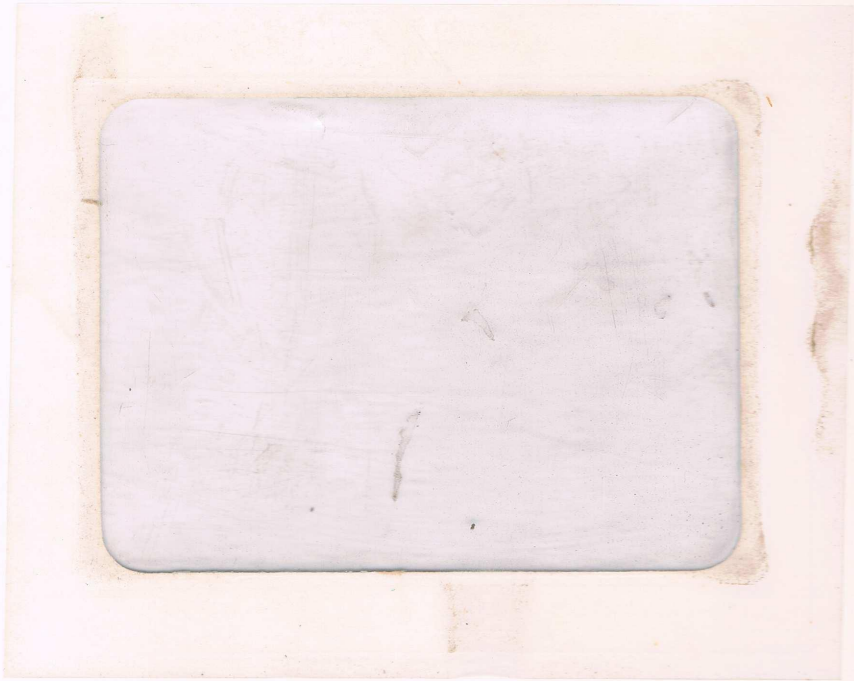
Service Manual

TORQUE CONVERTER
TRANSMISSION FOR
240A, 250A, 260A, 270A, 4500B

FORM

SM-TC

MAY, 1979



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Due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to improve machines.

Periodic revisions may be made to this publication and mailed automatically to distributors. It is recommended that customers contact their distributor for information on the latest revision.

TORQUE CONVERTER TRANSMISSION FOR 240A, 250A, 260A, 270A, 4500B

FORM

SM-TC

MAY, 1979

SECTION INDEX

GENERAL

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GENERAL

DESCRIPTION

The torque converter transmission is comprised of the following major components: a torque converter unit, a dump and modulation control valve, regulating junction valve, transmission top cover, shifter rail and forks, power take-off shaft, an oil distributing housing, reverse idler gear drive, hydraulic clutch pack, top driven gears, the bottom drive gears and a charge pump.

The torque converter unit is splined to the clutch pack shaft and stator support shaft. Fluid to drive the torque converter comes from the charge pump through dump and modulation control valve. Engine output power is transmitted through the torque converter to the clutch pack. Directional movement is controlled by the dump and modulation control valve and the clutch pack.

Detailed descriptions of each major component are outlined under the specific component headings throughout this book.

GENERAL

DESCRIPTION OF OPERATION

FIRST SPEED FORWARD (Fig. 1)

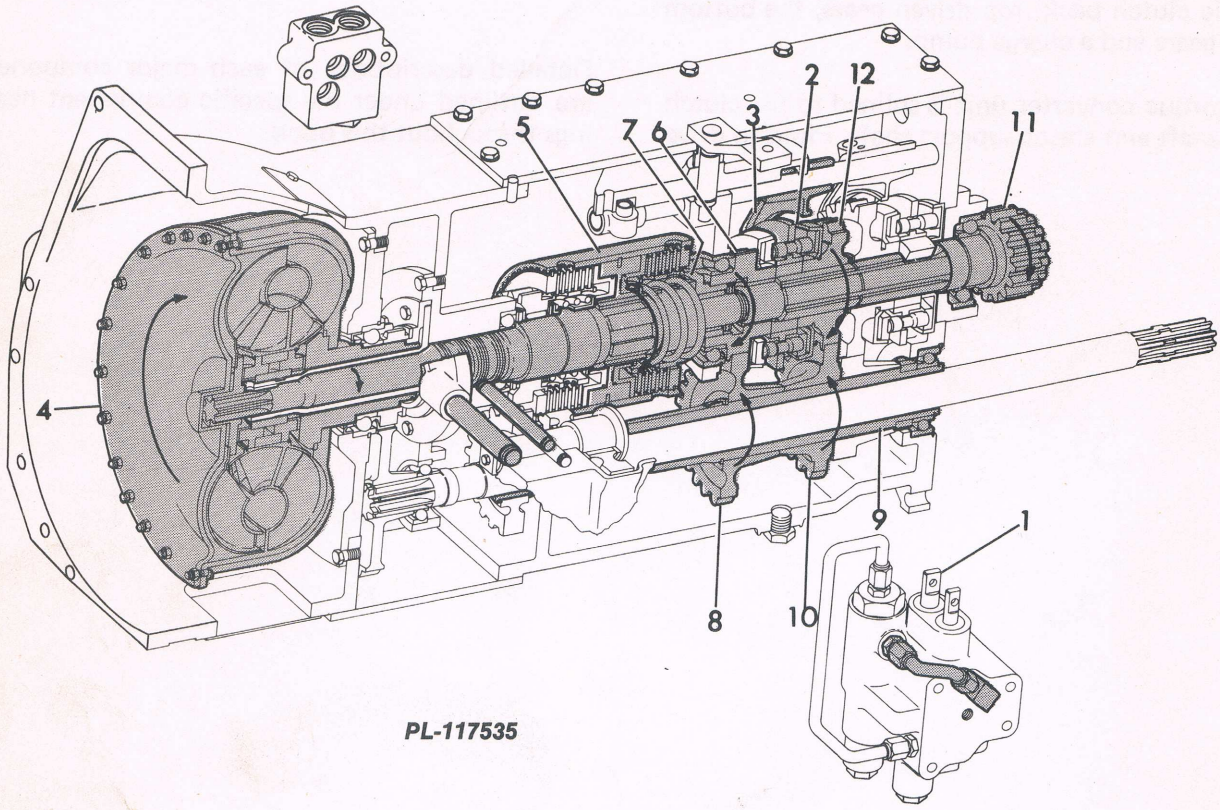

Fig. 1
First Speed Forward

1. Dump and Modulation Control Valve Spool
2. First Speed Synchronizer
3. First Speed Shift Linkage
4. Torque Converter
5. Forward Clutch Pack
6. Constant Mesh Drive Gear
7. Forward Clutch Pack Drive Gear
8. Constant Mesh Driven Gear
9. Countershaft
10. First Speed Drive Gear
11. Main Shaft
12. First Speed Driven Gear

In first speed forward, the dump and modulation control valve spool (1) is engaged in the forward position. First speed synchronizer (2) is engaged by the first speed shift linkage (3).

Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged forward clutch pack (5). Rotation and torque is transmitted to the constant mesh drive gear (6) through the forward clutch pack gear (7). Rotation from the constant mesh drive gear (6) forces the constant mesh driven gear (8), the countershaft (9) and the first speed drive gear (10) to be rotated in the opposite direction. The main shaft (11) is then driven by the first speed driven gear (12) off the first speed drive gear (10) in the opposite direction of rotation.

SECOND SPEED FORWARD (Fig. 2)

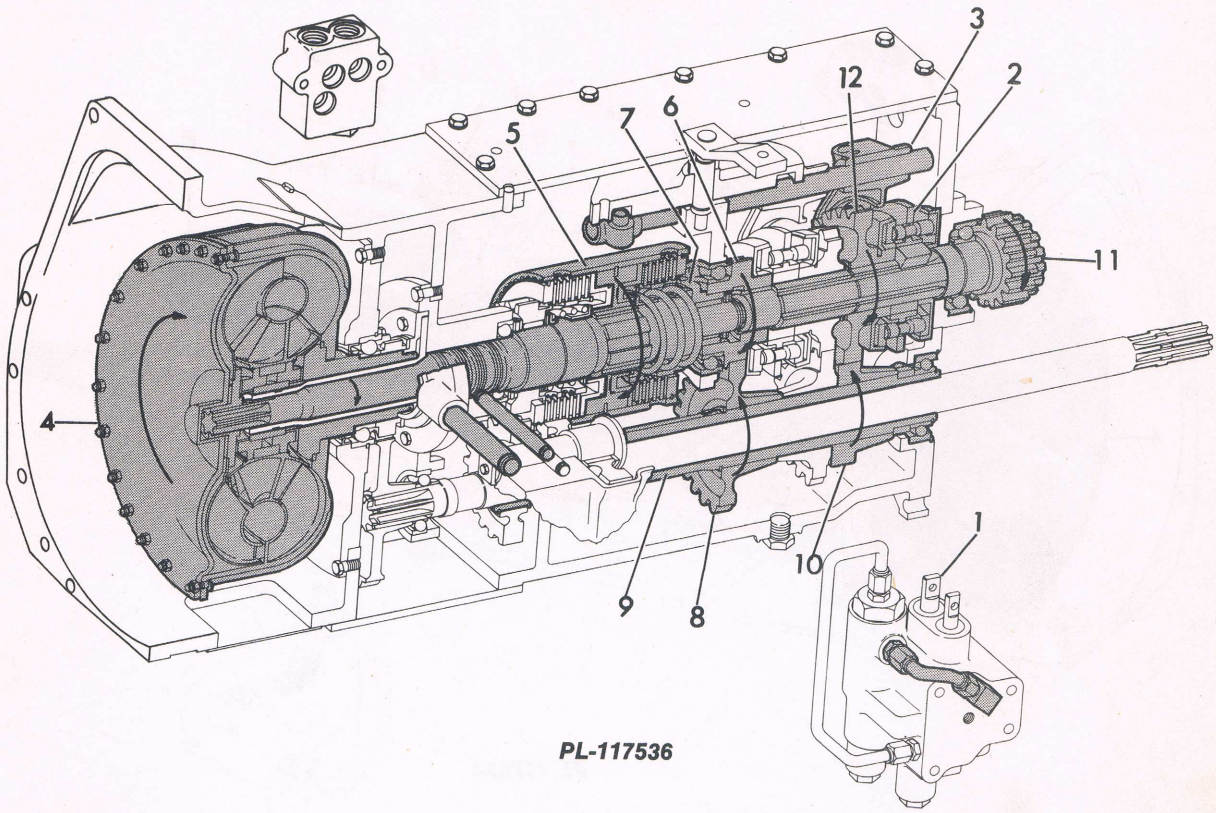

Fig. 2
Second Speed Forward

1. Dump and Modulation Control Valve Spool
2. Second Speed Synchronizer
3. Second Speed Shift Linkage
4. Torque Converter
5. Forward Clutch Pack
6. Constant Mesh Drive Gear
7. Forward Clutch Pack Drive Gear
8. Constant Mesh Driven Gear
9. Countershaft
10. Second Speed Drive Gear
11. Main Shaft
12. Second Speed Driven Gear

In second speed forward, the dump and modulation control valve spool (1) is engaged in the forward position. Second speed synchronizer (2) is engaged by the second speed shift linkage (3).

Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged forward clutch pack (5). Rotation and torque is transmitted to the constant mesh drive gear (6) through the forward clutch pack drive gear (7). Rotation from the constant mesh drive gear (6) forces the constant mesh driven gear (8), the countershaft (9) and the second speed drive gear (10) to be rotated in the opposite direction. The main shaft (11) is then driven by the second speed driven gear (12) off the second speed drive gear (10) in the opposite direction of rotation.

GENERAL

DESCRIPTION OF OPERATION

THIRD SPEED FORWARD (Fig. 3)

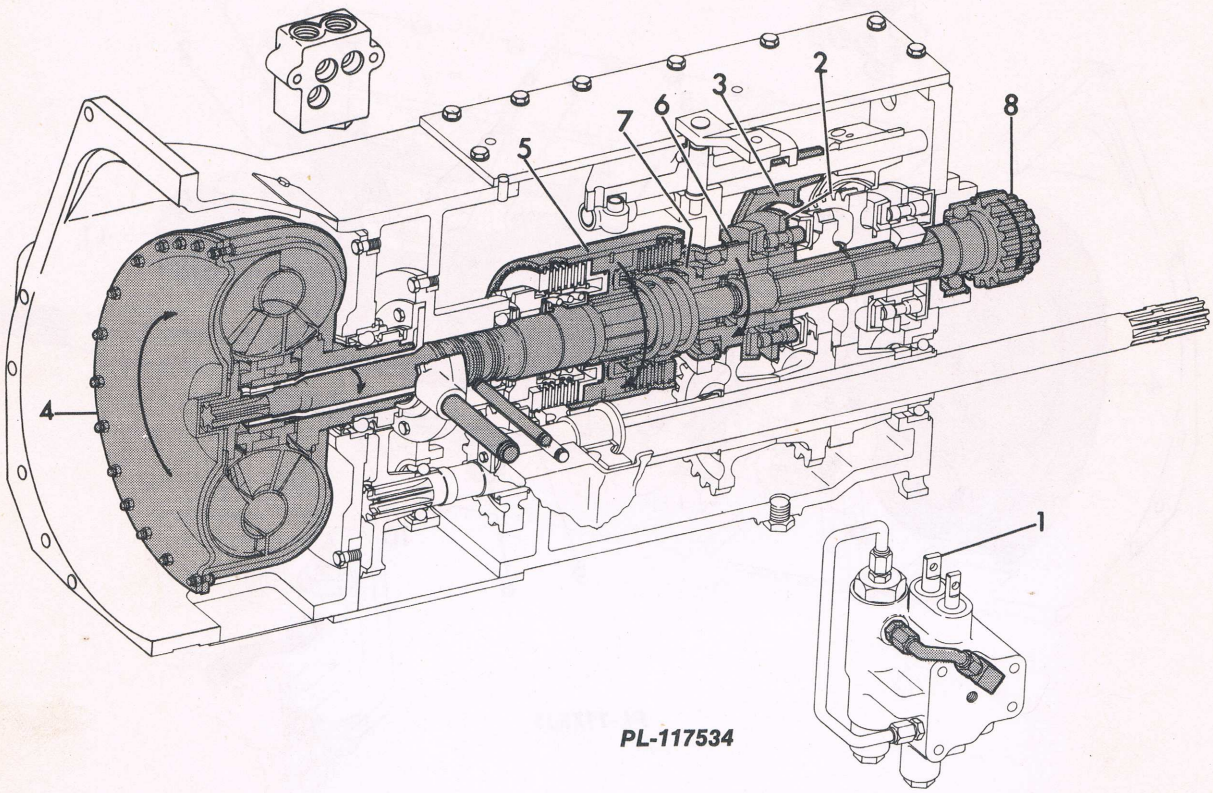

Fig. 3
Third Speed Forward

1. Dump and Modulation Control Valve Spool
2. Third Speed Synchronizer
3. Third Speed Shift Linkage
4. Torque Converter
5. Forward Clutch Pack
6. Constant Mesh Drive Gear
7. Forward Clutch Pack Drive Gear
8. Main Shaft

In third speed forward, the dump and modulation control valve spool (1) is engaged in the forward position. Third speed synchronizer (2) is engaged by the third speed shift linkage (3). Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged forward clutch pack (5). Rotation and torque is transmitted to the constant mesh drive gear (6) through the forward clutch pack drive gear (7). The main shaft (8) is directly driven by the constant mesh drive gear (6) through the coupled synchronizer (2).

FIRST SPEED REVERSE (Fig. 4)

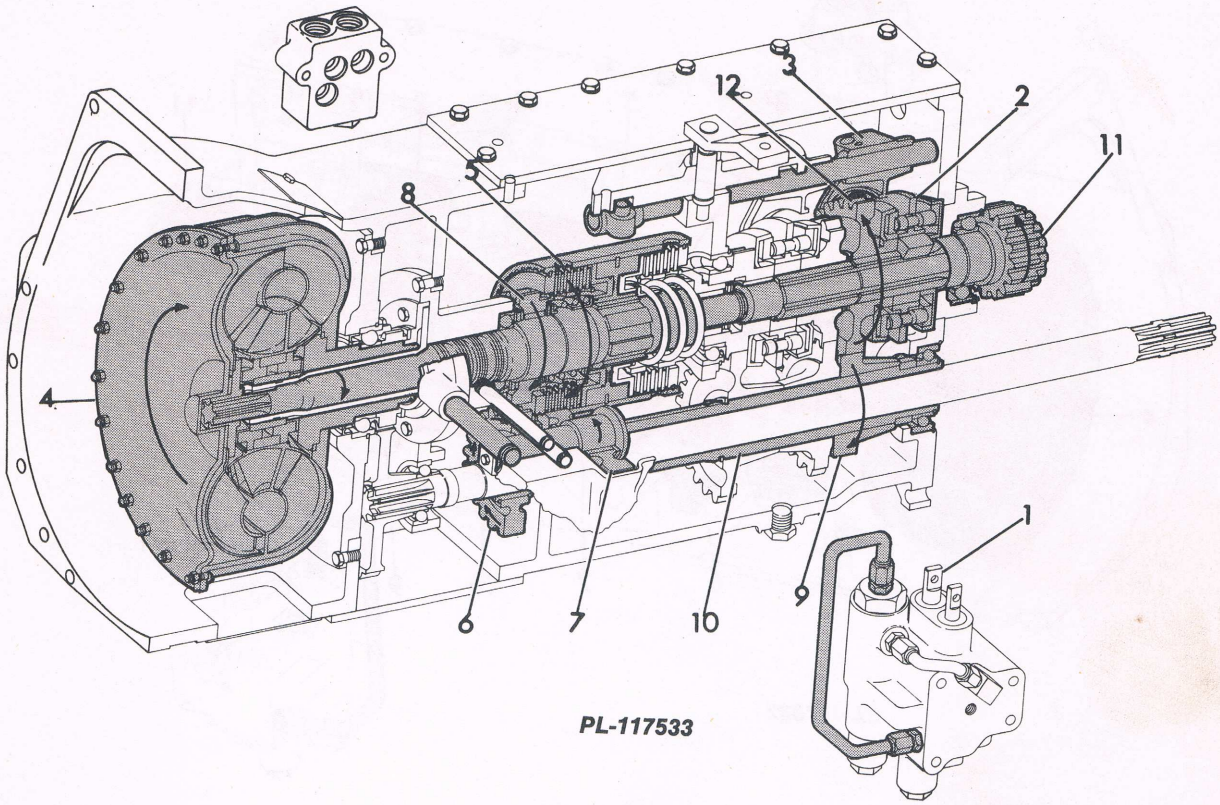

Fig. 4
First Speed Reverse

1. Dump and Modulation Control Valve Spool
2. First Speed Synchronizer
3. First Speed Shift Linkage
4. Torque Converter
5. Reverse Clutch Pack
6. Reverse Driven Gear
7. Reverse Idler Gear
8. Reverse Clutch Pack Drive Gear
9. First Speed Drive Gear
10. Countershaft
11. Main Drive Shaft
12. First Speed Driven Gear

In first speed reverse the dump and modulation control valve spool (1) is engaged in the reverse position. First speed synchronizer (2) is engaged by the first speed shift linkage (3). Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged reverse clutch pack (5). Rotation and torque is trans mitted to the reverse driven gear (6) through the reverse idler gear (7) from the reverse clutch pack drive gear (8). Rotation of the first speed drive gear (9) from the reverse driven gear (6) is transmitted through the countershaft (10) in the same direction. The main shaft (11) is then driven by the first speed driven gear (12) off the first speed drive gear (9) in the opposite direction of rotation.

GENERAL

DESCRIPTION OF OPERATION

SECOND SPEED REVERSE (Fig. 5)

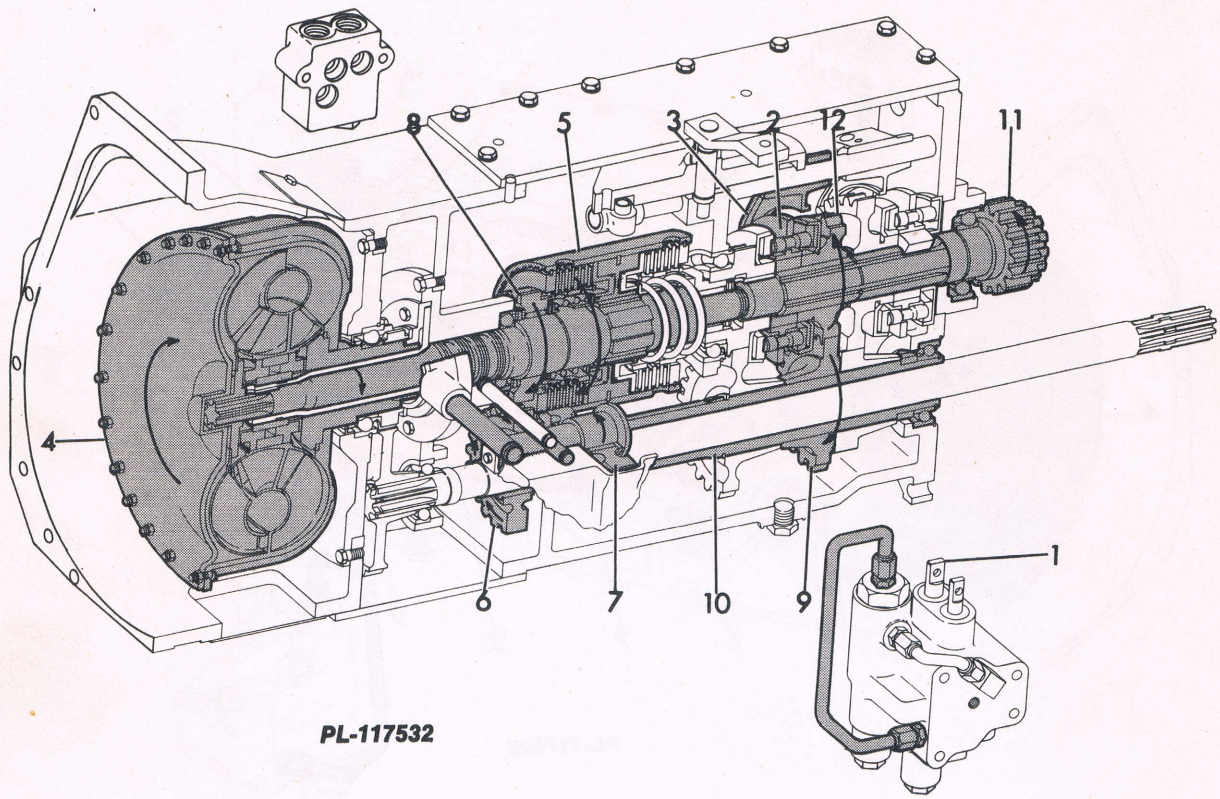

Fig. 5
Second Speed Reverse

1. Dump and Modulation Control Valve Spool
2. Second Speed Synchronizer
3. Second Speed Shift Linkage
4. Torque Converter
5. Reverse Clutch Pack
6. Reverse Driven Gear
7. Reverse Idler Gear
8. Reverse Clutch Pack Drive Gear
9. Second Speed Drive Gear
10. Countershaft
11. Main Drive Shaft
12. Second Speed Driven Gear

In second speed reverse the dump and modulation control valve spool (1) is engaged in the reverse position. Second speed synchronizer (2) is engaged by the second speed shift linkage (3). Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged reverse clutch pack (5). Rotation and torque is transmitted to the reverse driven gear (6) through the reverse idler gear (7) from the reverse clutch pack drive gear (8). Rotation of the second speed drive gear (9) from the reverse driven gear (6) is transmitted through the countershaft (10) in the same direction. The main shaft (11) is then driven by the second speed driven gear (12) off the second speed drive gear (9) in the opposite direction of rotation.

DESCRIPTION OF OPERATION

THIRD SPEED REVERSE (Fig. 6)

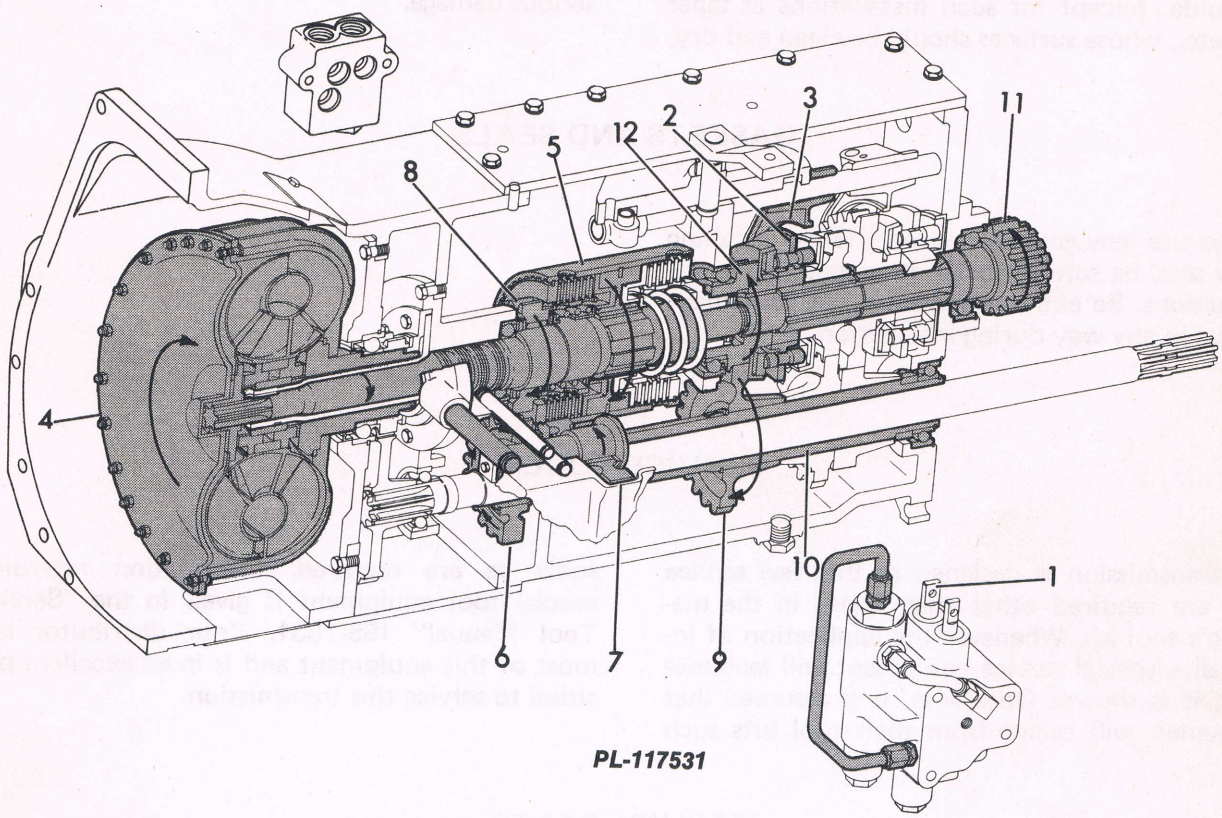

Fig. 6
Third Speed Reverse

1. Dump and Modulation Control Valve Spool
2. Third Speed Synchronizer
3. Third Speed Shift Linkage
4. Torque Converter
5. Reverse Clutch Pack
6. Reverse Driven Gear
7. Reverse Idler Gear
8. Reverse Clutch Pack Drive Gear
9. Third Speed Drive Gear (Constant Mesh Driven Gear)
10. Countershaft
11. Main Drive Shaft
12. Third Speed Driven Gear (Constant Mesh Drive Gear)

In third speed reverse the dump and modulation control valve spool (1) is engaged in the reverse position. Third speed synchronizer (2) is engaged by the third speed shift linkage (3). Torque from the engine passes, by hydraulic action, through the torque converter (4) to the engaged reverse clutch pack (5). Rotation and torque is transmitted to the reverse driven gear (6) through the reverse idler gear (7) from the reverse clutch pack drive gear (8). Rotation of the third speed drive gear (9) from the reverse driven gear (6) is transmitted through the countershaft (10) in the same direction. The main shaft (11) is then driven by the third speed driven gear (12) off the third speed drive gear (9) in the opposite direction of rotation.

GENERAL

LUBRICATION

Instructions on the lubrication of each assembly are given in the Service Guide in the operator's manual. When assembling any parts, always coat all wearing surfaces with the lubricant specified in the guide. Except for such installations as taper pins, etc., whose surfaces should be clean and dry, use sufficient quantities of lubricant to prevent any danger of seizing, scoring, or excessive wear when the assembly is first operated. Failure to provide "starting lubrication" may result in serious damage.

GASKETS AND SEALS

Always use new gaskets and seals. When installing a new seal, be sure to install it as specified in the instructions. Be extremely careful not to damage the seal in any way during installation.

SERVICE TOOLS

This transmission is designed so that few service tools are required other than those in the mechanic's tool kit. Whenever the application of inexpensive special service equipment will facilitate work, it is shown. Otherwise, it is assumed that servicemen will select from their tool kits such tools as are required. Information regarding special tool equipment is given in the "Service Tool Manual" ISS-1531. Your distributor has most of this equipment and is in an excellent position to service this transmission.

SERVICE PARTS

Always use genuine IH service parts. The best material obtainable and experience gathered through many years of manufacturing, enable International Harvester to produce quality that will not be found in imitation or "just as good" repair parts. No serviceman can afford to guarantee a repair job that is not serviced with genuine IH parts. No owner should be satisfied with other than genuine IH parts.

For the correct service parts to be used on a machine, always refer to the parts catalog for that particular machine. The microfiche and loose-leaf parts catalogs are accurate and are continually being brought up-to-date by the issuance of new pages and microfiche covering any changes in part numbers.

GENERAL SAFETY PRECAUTIONS

A great deal of material contained in this service manual concerns itself with the removal and installation of exceptionally heavy items. During the time these operations are being carried out, safe working conditions and procedures are mandatory, to not only insure personal safety but the safety of others in the area. The following items are listed as a reminder of basic shop safety practices, too often neglected in day-to-day operation.

Hoists must be of sufficient capacity to lift the heavier units and have an ample safety margin.

Floors must be clean and dry. After draining operations be sure all spillage is cleaned up. Electrical cords and wet floors make a dangerous combination.

Be sure heavy items are properly supported from hoist or floor jack before removing supporting members from machine.

Have sufficient service personnel available when removing or installing large heavy items in order to maintain control at all times.

If a heavy item begins to fall, let it fall; don't try to catch it.

Think before you act. Carelessness is one luxury the serviceman cannot afford.

RECOMMENDED BEARING PROCEDURES

NEW BEARINGS

Keep bearings in original cartons or wrappings until ready for use. If package is opened and bearing is not used immediately, protect it by re-wrapping.

Before wrapping and packing, bearings are carefully cleaned by the manufacturer and are thoroughly coated with a protective lubricant.

Keep bearings clean and away from moisture.

Handle bearings with clean hands and use clean tools. Handle bearings as little as possible. Finger marks are hard to wash off and perspiration starts corrosion.

Don't wash the oil or grease out of a new bearing.

Don't take new bearings apart. They were assembled correctly in the first place.

BEARING REMOVAL

Wash off bearing housing; take care to prevent loose dirt from entering the housing.

Take a few moments to study the assembly. Determine the best way to undertake bearing removal.

Be careful and avoid damage. The bearings may be good enough to use again.

The best tool for removing a bearing is usually an arbor press. Most field work, however, is done with some type of bearing puller. Where required, this manual will refer to the correct tool to employ. Use it for speed and safety.

To remove a bearing, press or pull only on the race that is tight.

Press or pull straight and square and keep the race from cocking and scoring the shaft or damaging the bearing.

Never press or pull against bearing shields or separators.

Keep the press table and support blocks clean and square. Provide some means to keep the shaft from falling on the floor. Protect the end of the shaft with a pad of lead, copper or other soft metal or a hardwood block.

Use pullers properly. Set them up so that they will push or pull straight and square. Take care not to damage shaft threads, keyways or shoulders in the process.

(continued on next page)

GENERAL

RECOMMENDED BEARING PROCEDURES

With proper care, bearings may be removed quite safely with improvised methods when the right tools are not available.

A vise may do in place of an arbor press and a drift can take the place of the press ram. If the shaft is held in a vise, protect its surface with copper sheet or hardwood blocks.

A suitable block, placed over the end of a tube type driver, will allow the hammer blows to be struck in dead center. This will prevent the bearing from cocking.

If bearing fit does not permit the use of a bearing puller or arbor press the bearing will have to be cut off. Cut the outer race and ball retainer with an acetylene torch. Burn the inner race only part way through. This will protect the shaft. Crack the race the rest of the way with a hammer and chisel, using care to prevent personal injury from flying parts.

CLEANING

Don't judge the condition of a bearing until after it has been cleaned.

Don't spin dirty bearings. Rotate them slowly while washing.

Don't spin any bearings with an air hose. Rotate one race by hand, when using air, to expose all parts of the bearing.

Bearings with a shield or seal on one side only should be washed, inspected and handled in the same manner as bearings without shields or seals.

Bearings with shields or seals on both sides should not be washed. Wipe them off to keep dirt from working inside. Smooth turning bearings may be coated with protective lubricant and then wrapped and stored or used in their original application.

If a small tank and wire baskets to soak and wash bearings are not available, a clean grease can or bucket filled with solvent may be used.

Let the bearing soak long enough to loosen the grease and dirt. This may require several hours or

longer. The slosh the bearing around near the top of the container, giving it a turn now and then until it is clean. Rinse in a clean container of c clean solvent.

A short, clean bristle brush from which the bristles will not come out or break off is a help in removing dirt, scale or chips.

After bearings have been thoroughly cleaned, inspect them immediately.

INSPECTION

A little tarnish, stain or corrosion on the outside surfaces of the races is not detrimental to the operation of the bearing and need not be removed.

Bearings are inspected by holding the inner race so that its axis is vertical (bearing is then horizontal), and turning the outer race slowly.

Bearings should not be rejected because they feel slightly rough or have a tendency to stick at certain points when rotated by hand until the bearings have been re-cleaned. If bearings still feel rough and/or have a catch, inspect them closely to determine the cause.

The following defects are common causes of bearing rejection:

Broken or cracked races.

Dented seals or shields.

Cracked or broken separators.

Broken or cracked balls or rollers.

Flaked areas on balls, rollers or raceways.

Bearings that have been overheated. These bearings are generally darkened to brownish blue or blue-black color.

Bearings whose raceways are indented or "brinelled" by ball or roller impressions in the races.

RECOMMENDED BEARING PROCEDURES

An anti-friction bearing, properly lubricated, should not wear unless dirt or abrasive foreign matter gets into it. If dirt is allowed to enter a bearing it mixes with the grease or oil and forms a lapping compound that will quickly lap down the balls or rollers.

The load carrying surfaces of anit-friction bearings are finished with extreme care and will sustain very heavy loads unless the surfaces are damaged by abuse in handling or by foreign matter which may be abrasive or corrosive.

BEARING INSTALLATION

Clean shafts and bearing housings thoroughly. Remove all dirt from keyways, splines and grooves. Remove burrs and slivers.

Clean and oil bearing seats.

Press bearings in straight and square.

Press only on the tight fitting race.

Press bearings until they are seated against the shaft or housing shoulder.

Bearing installation is just the reverse of bearing removal. Use an arbor press if available. Press the shaft into the bearing, supporting the inner race on blocks or a suitable press adapter to prevent bearing damage. Be sure the blocks or adapter does not scrape the shaft or threads.

If the distance between the end of the shaft and the bearing seat is fairly short, hold the shaft in a vise or suitable support and press the bearing onto the shaft with a clean tube. This may be done either in an arbor press or by tapping with a hammer. Cover the end of the tube with a suitable soft metal or hardwood block. This will allow the hammer blows to strike the tube dead-center and avoid cocking the bearing.

Do not leave bearings exposed in partial assemblies. Cover the bearings until ready to complete the assembly, to prevent damage by moisture, dirt or other foreign matter. Any clean cloth or paper will do as long as the bearings are well covered.

HEATING BEARINGS FOR INSTALLATION

The inner bearing race, in some applications, may be shrunk on the shaft. This is a very simple operation consisting of heating the bearing in clean oil (Fig. 7) or temperature controlled oven to a temperature of between 93° and 121° C (200° and 250° F). This expands the inner race sufficiently to allow it to slip over the shaft to the bearing seat. DO NOT OVERHEAT THE BEARING OR IT WILL LOSE ITS HARDNESS. Do not keep the bearing in the oil or oven after the correct temperature has been reached.

If expanding the race is not enough to get it on the shaft, freeze the shaft in dry ice for approximately 30 minutes. This will shrink the shaft and allow bearing installation.

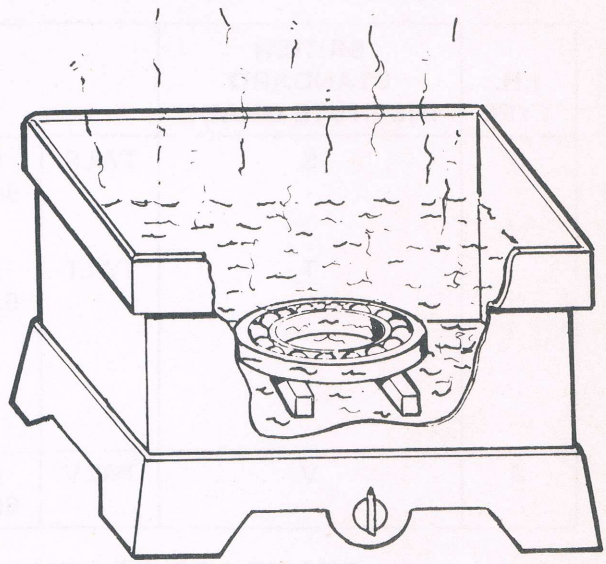

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Fig. 7
Expanding Bearing in Heated Oil

ADJUSTMENT

Certain types of ball bearings and most dual-purpose bearings with tapered or barrel shaped roller require adjustment in assembly. Specific instructions covering bearing adjustment are contained in this manual where required.

If a bearing is set up too tight it will heat up and fail. Loose bearings will pound and fail or cause component parts to fail. Be sure to follow the bearing adjustment procedures carefully.

GENERAL

BOLT IDENTIFICATION CHARTS

U.S. BOLT TYPE IDENTIFICATION CHART

I.H. TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING*
1	Equivalent 1 or 2	WILL HAVE A IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	5	WILL HAVE A IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	8	WILL HAVE A IH AND 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

*The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have an I.H. or a raised dot which previously identified I.H. bolts.

U.K. (BRITISH) BOLT TYPE IDENTIFICATION CHART

I.H. TYPE	BRITISH STANDARD INSTITUTE GRADE	BOLT HEAD MARKING					
5	S	TWLS	BEES 50-S-55	NEWALL HITENSILE "S"	SPNS	NEWTON S	SPARTS S
	T	TWLT	BEES 55-T-65	NEWALLOY T OR NEWALL HITENSILE "T"	SPNT	NEWTON T	SPARTS T
8	V	TWLV	BEES 65-V-75	NEWALLOY "V"	SPNV	NEWTON V	SPARTS V

STANDARD TORQUE DATA FOR NUTS AND BOLTS

TYPE 1, 5 AND 8 HARDWARE

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts provided:

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
B. Joints are rigid, that is, no gaskets or compressible materials are used.
C. When reusing nuts or bolts use minimum torque values.

NOTE: *Multiply the standard torque by:*

0.65 when finished jam nuts are used.
0.70 when Molykote, white lead or similar mixtures are used as lubricants.
0.75 when parkerized bolts or nuts are used.
0.85 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
0.90 when hardened surfaces are used under the nut or bolt head.

When reusing bolts and nuts in service, use minimum torque values.

STANDARD TORQUE DATA FOR NUTS AND BOLTS

BOLT SIZE	TYPE 1 STUDS ONLY				TYPE 1 6" LENGTH OR LESS				TYPE 1 LONGER THAN 6"			
	MIN.		MAX.		MIN.		MAX.		MIN.		MAX.	
	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs
1/4	7	5	8	6	7	5	8	6	4	3	4	3
5/16	16	12	18	13	16	12	18	13	8	6	9	7
3/8	28	21	33	24	28	21	33	24	15	11	18	13
7/16	47	35	51	38	47	35	51	38	26	19	28	21
1/2	71	52	77	58	71	52	77	58	39	29	43	32
9/16	95	70	108	80	95	70	108	80	55	41	62	46
5/8	133	98	149	110	133	98	149	110	77	57	85	63
3/4	236	174	264	195	236	174	264	195	136	100	152	112
7/8	407	300	447	330	220	162	245	181	220	162	245	181
1	569	420	637	470	339	250	366	270	339	250	366	270
1-1/8	813	600	895	660	475	350	651	380	475	350	651	380
1-1/4	1139	840	1274	940	664	490	732	540	664	490	732	540
1-1/2	1993	1470	2224	1640	1152	850	1274	940	1152	850	1274	940
1-3/4	3186	2350	3322	2450	1803	1330	2020	1490	1803	1330	2020	1490
2	4745	3500	5288	3700	2712	2000	2983	2200	2712	2000	2438	2200

BOLT SIZE	TYPE 5				TYPE 8				TYPE 8 - SPECIAL USE (SEE NOTE)			
	MIN.		MAX.		MIN.		MAX.		MIN.		MAX.	
	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs	N.m	Ft-Lbs
1/4	12	9	14	10	16	12	19	15	15	11	18	13
5/16	26	19	28	21	37	27	41	30	33	24	37	27
3/8	43	33	50	37	61	45	68	50	57	43	64	47
7/16	71	53	81	60	102	75	115	85	94	69	103	76
1/2	108	80	122	90	156	115	176	130	141	104	159	117
9/16	156	115	176	130	217	160	244	180	203	150	230	170
5/8	217	160	244	180	298	220	339	250	285	210	312	230
3/4	298	290	434	320	542	400	610	450	475	350	529	390
7/8	583	420	637	470	881	650	990	730	746	570	827	630
1	854	630	963	710	1315	970	2834	1090	1125	850	1261	950
1-1/8	1152	850	1288	950	3227	1380	3457	1550	1600	1220	1803	1350
1-1/4	1726	1200	1830	1350	3986	1940	5532	2180	2278	1700	2549	1900
1-1/2	5423	2000	5830	2300	8542	3300	9084	3700	8134	3000	8542	3300
1-3/4	8541	3300	9084	3700	13965	5300	16270	6000	11796	4700	12474	5200
2	13559	5000	14236	5500	21693	8000	24405	9000	18981	7000	20066	7800

NOTE: *This column of torque represents maximum torques for capscrews in gray iron, when tread length engagement is at least 1-1/2 diameters.*

TORQUE VALUES FOR SPLIT FLANGE CONNECTIONS

The following chart provides the tightening torques for split flange connections used in hydraulic systems. Split flanges and fitting shoulders should fit squarely. Install all bolts, finger tight and, then torque evenly.

NOTE: *Overtorquing bolts will damage the flanges and/or bolts, which may cause leakage.*

FLANGE SIZE IN INCHES (*)	BOLT SIZE IN INCHES	BOLT TORQUE	
		NEWTON METERS	FOOT POUNDS
1/2	5/16	20-24	15-18
3/4	3/8	20-37	22-27
1	3/8	37-47	27-35
1-1/4	7/16	47-61	35-45
1-1/2	1/2	62-79	46-58
2	1/2	75-88	55-65
2-1/2	1/2	107-123	79-91
3	5/8	187-203	138-150
3-1/2	5/8	159-180	117-133

(*) Inside diameter of hydraulic tube or hose fitting.

TORQUE VALUES FOR TUBE NUTS
(For 37 degree flared fittings)

SIZE	TUBING O.D.	THREAD SIZE	TORQUE N.m		TORQUE FT-LBS	
			MIN.	MAX.	MIN.	MAX.
4	1/4	7/16-20	13.6	27.1	10	20
5	5/16	1/2-20	20.3	33.9	15	25
6	3/8	9/16-18	33.9	47.5	25	35
8	1/2	3/4-16	54.2	61.0	40	55
10	5/8	7/8-14	61.0	101.7	55	75
12	3/4	1-1/16-12	101.7	128.8	75	95
14	7/8	1-3/16-12	128.8	155.9	95	115
16	1	1-5/16-12	155.9	196.6	115	145
20	1-1/4	1-5/8-12	203.4	244.0	150	180
24	1-1/2	1-7/8-12	271.2	338.9	200	250
32	2	2-1/2-12	406.7	474.5	300	350

TORQUE VALUES FOR TYPE 8 PHOSPHATE COATED HARDWARE

This chart provides tightening torque for applications as listed in the Parts Catalog for the machine involved. DO NOT SUBSTITUTE. Original equipment hardware defined as I.H. Type 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell "C" 38-45). All phosphate coated and assembled without supplemental lubrication (as received condition).

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.

2. Phosphate coated bolts used with phosphated coated prevailing torque nuts (nuts with distorted threads or plastic inserts).

3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade ONLY and are NOT to be used to determine required torque.

NOMINAL THREAD DIAMETER	STANDARD TORQUE PLUS OR MINUS 10%	
	NEWTON METERS	FOOT LBS.
1/4	10	7
5/16	19	14
3/8	32	24
7/16	51	38
1/2	80	60
9/16	110	80
5/8	155	115
3/4	270	200
7/8	440	320
1	650	480
1-1/8	800	590
1-1/4	1100	830
1-3/8	1500	1100
1-1/2	1900	1400
1-3/4	3100	2300
2	4600	3400

TORQUE VALUES FOR HOSE CLAMPS
(For special torque data, refer to "SPECIAL TORQUES")

The following chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic systems, etc.)

CLAMP TYPE & SIZE	TORQUE PLUS OR MINUS 5%			
	RADIATOR, AIR CLEANER, BOOTS, ETC.		HYDRAULIC SYSTEM	
	NEWTON METERS	INCH LBS.	NEWTON METERS	INCH LBS.
"T" Bolt (Any Diameter)	6.8	60	5.1	45
Worm Drive — 1-3/4" Open Diameter & Under	2.8	25	5.1	25
Worm Drive — Over 1-3/4" Open Diameter	5.1	45	5.1	45

GENERAL

TORQUE VALUES FOR "O" RING BOSS PLUGS, JIC 37° SEAT, SWIVEL NUTS

SIZE	THREAD SIZE	TORQUE N.m		TORQUE FT-LBS	
		MIN.	MAX.	MIN.	MAX.
4	7/16-20	8.1	13.6	6	10
5	1/2-20	13.6	20.3	10	15
6	9/16-18	20.3	27.1	15	20
8	3/4-16	33.9	40.7	25	30
10	7/8-14	47.5	54.2	35	40
12	1-1/15-12	81.3	95.0	60	70
14	1-3/16-12	95.0	108.5	70	80
16	1-5/16-12	108.5	122.0	80	90
20	1-5/8-12	128.8	155.9	95	115
24	1-7/8-12	162.7	189.8	120	140
32	2-1/2-12	338.9	406.7	250	300

Above torque values are recommended fo plain, cadmium or zinc plated fittings, dry or wet installations.

Swivel nuts either swaged or brazed.

These torques are not recommended for tubes with wall thickness of .035 or less.

Specifications subject to change without notice.

SPECIAL TORQUES

Each machine has some non-standard torques which are necessary for proper component function. These are listed under "SPECIAL TORQUES" shown elsewhere in this manual. Typical examples are hose clamps, non-rigid joints (gaskets), non-ferrous fasteners or tapped holes, spanner nuts, fine thread fasteners, jam nuts, and cases where loading or distortion are critical factors.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

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REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

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REMOVAL OF MAJOR COMPONENTS

NOTE: *The following is a step by step removal procedure of major transmission components. Each step preceding the components to be serviced must be performed to service that component unless otherwise noted.*

NOTE: *The following components can be removed and serviced without splitting the machine: transmission top cover assembly (Refer to "TRANSMISSION TOP COVER ASSEMBLY" in this section), dump and modulation control valve (Refer to "DUMP AND MODULATION CONTROL VALVE" in Section 5) and the regulator junction valve (Refer to "REGULATOR JUNCTION VALVE" in Section 5).*

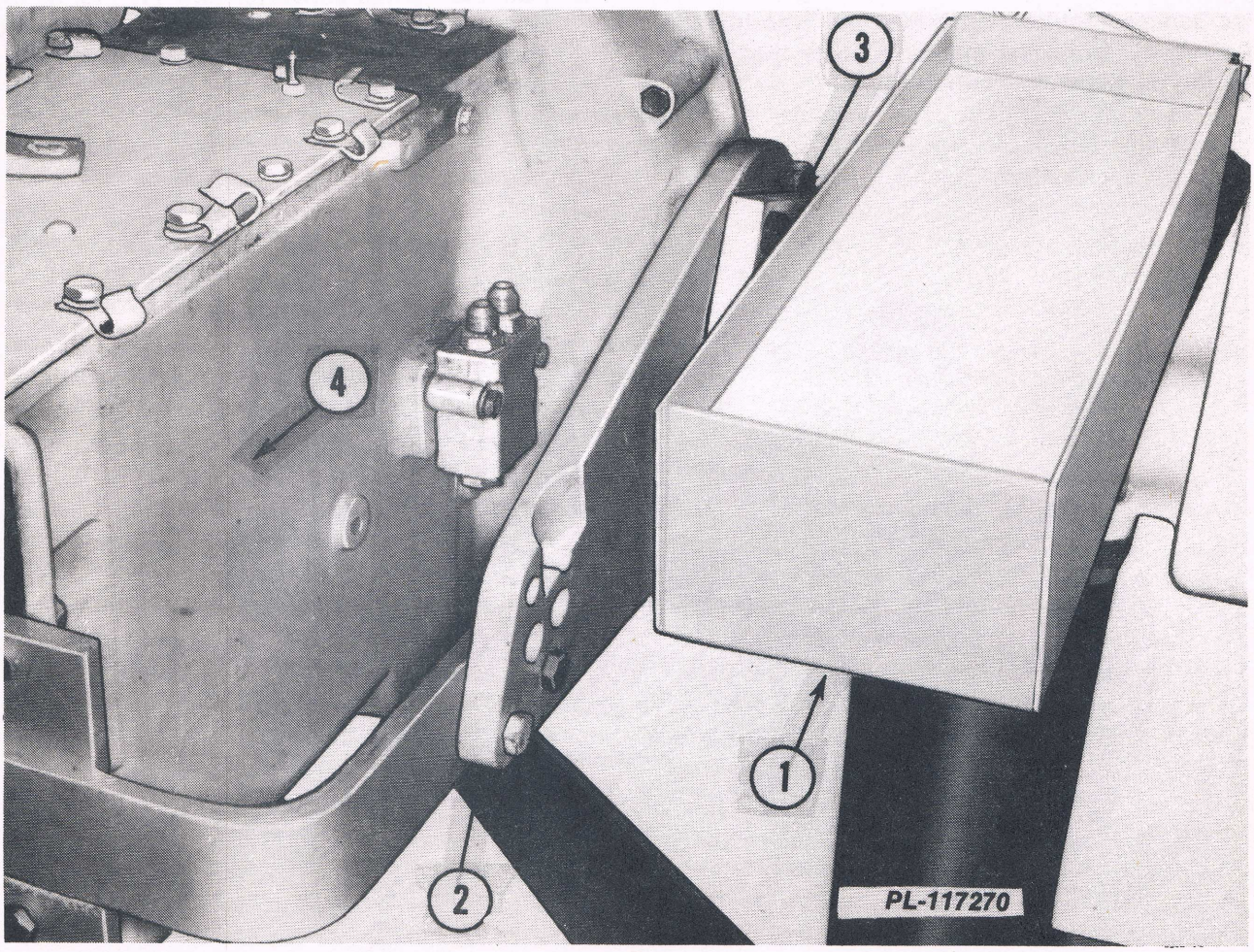

Fig. 1
Transmission Mounted on Stand

1. PLT Stand
2. PLT Adapter Plate
3. PLT Attaching Plate
4. Transmission

REMOVAL OF MAJOR COMPONENTS

NOTE: *The torque converter assembly can be removed and serviced without removing the transmission from the chassis. However, a front machine split must be performed. After splitting the machine, slide the torque converter from the transmission input shaft. Refer to chassis service manual for procedure of front tractor split (rear split on 4500B). Refer to Section 3 for service procedures on torque converter.*

For service requirement when the transmission is removed from the machine, place that transmission on stand as shown in Fig. 1.

NOTE: *Be sure when mounting transmission to stand not to allow the front of the transmission housing to tilt downward. The torque converter unit is not secured to the transmission input shaft, only splined on.*

REMOVAL OF TORQUE CONVERTER UNIT

1. Pull the torque converter unit (1, Fig. 3) off the splines of the transmission input shaft. Refer to Section 3 for service procedures on torque converter unit.

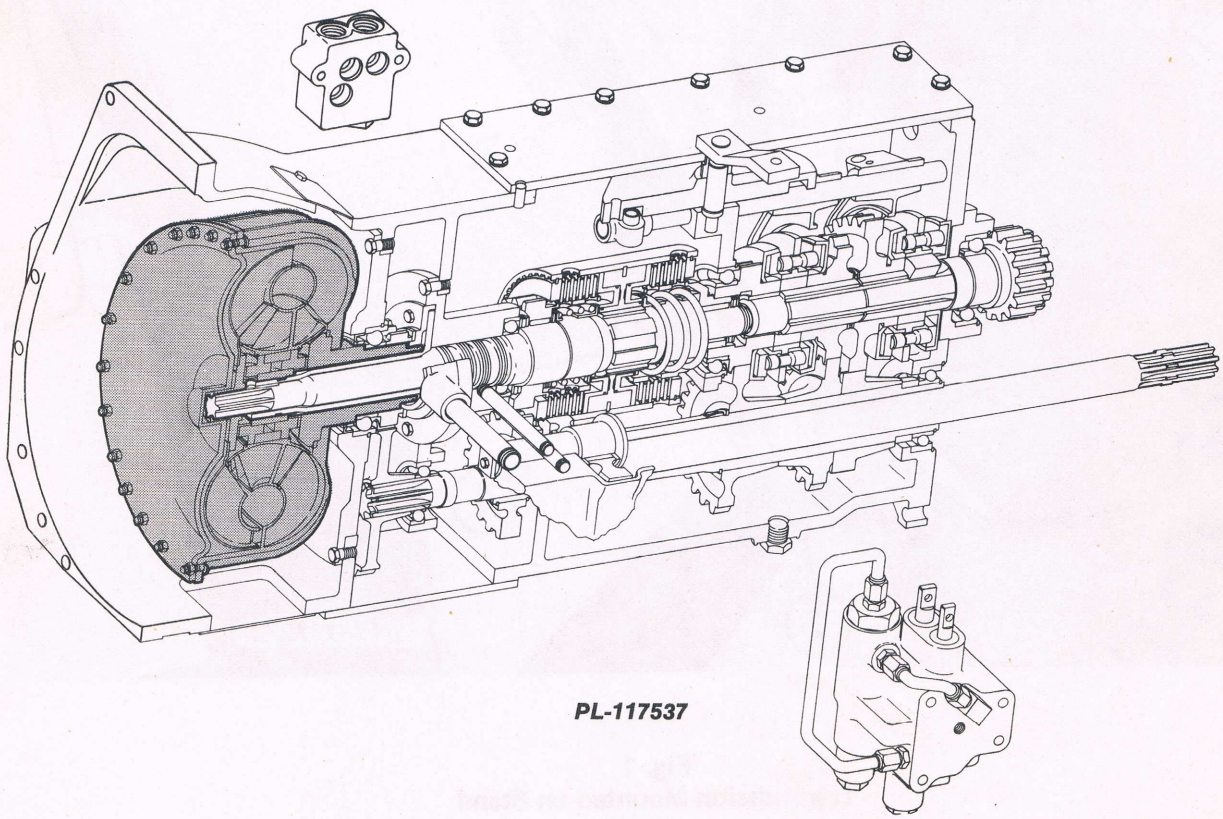

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Fig. 2
Torque Converter Area

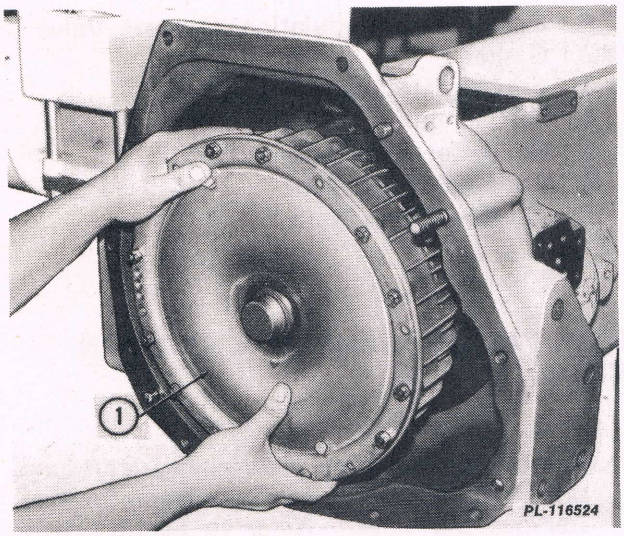

Fig. 3
Removing Torque Converter Unit

REMOVING THE DUMP AND MODULATION CONTROL VALVE

1. Remove the four bolts securing the dump and modulation control valve (1, Fig. 5) to the transmission housing. Remove the valve and gasket (2). Refer to Section 5 for service procedures on dump and modulation control valve.

NOTE: *The forward modulation tube (short tube on valve) (3) may have to be removed to remove one of the mounting bolts.*

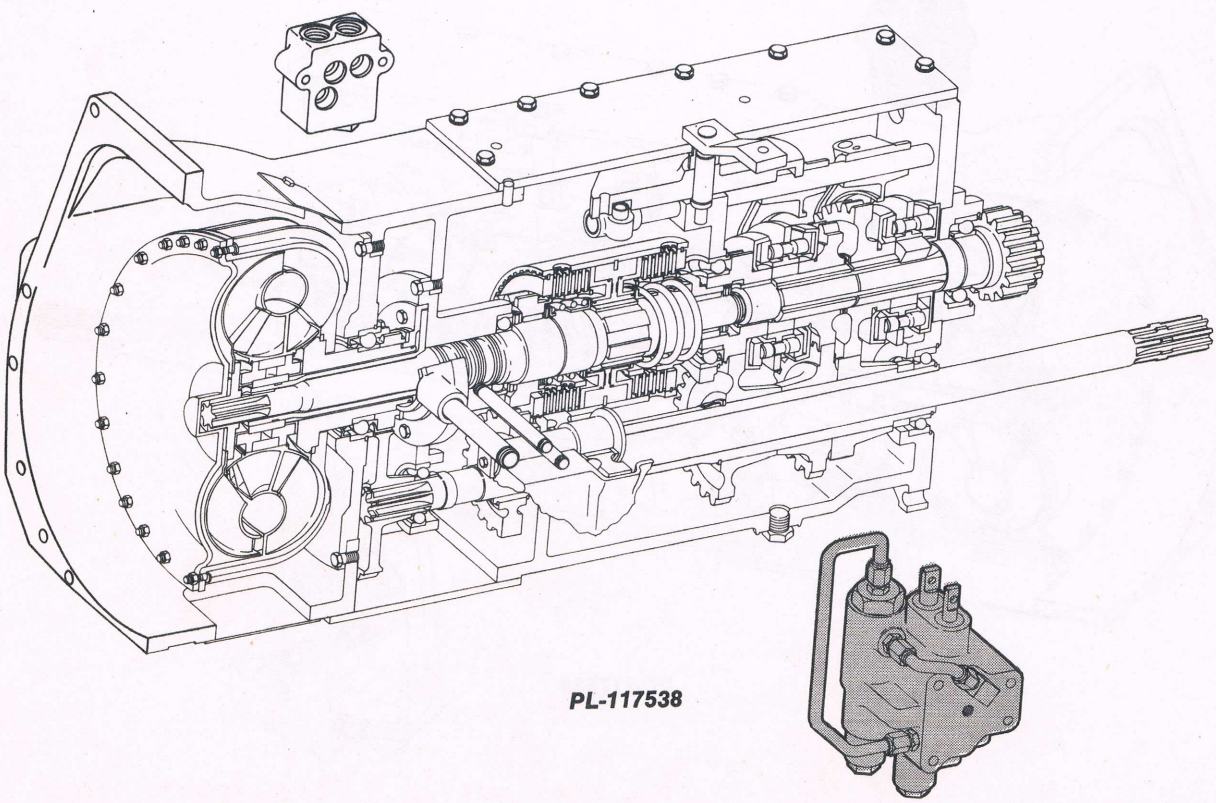

Fig. 4
Dump and Modulation Control Valve

REMOVAL OF MAJOR COMPONENTS

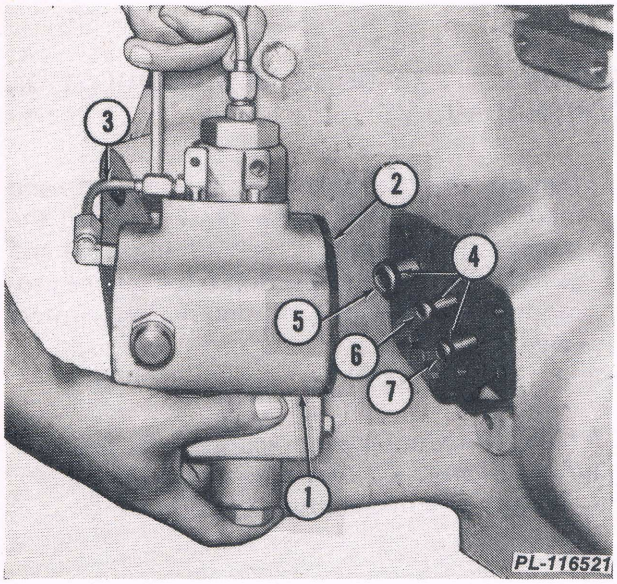

Fig. 5
Removing the Dump and Modulation Control Valve

Legend for Figure 5.

1. Dump and Modulation Control Valve
2. Gasket
3. Forward Modulation Tube
4. "O" Rings
5. Converter Inlet Tube
6. Forward Clutch Tube
7. Reverse Clutch Tube

REMOVAL OF REGULATOR JUNCTION VALVE

1. Remove the two bolts securing regulator junction valve (1, Fig. 7) to transmission housing. Remove the valve. Refer to Section 5 for service procedures on regulator junction valve.

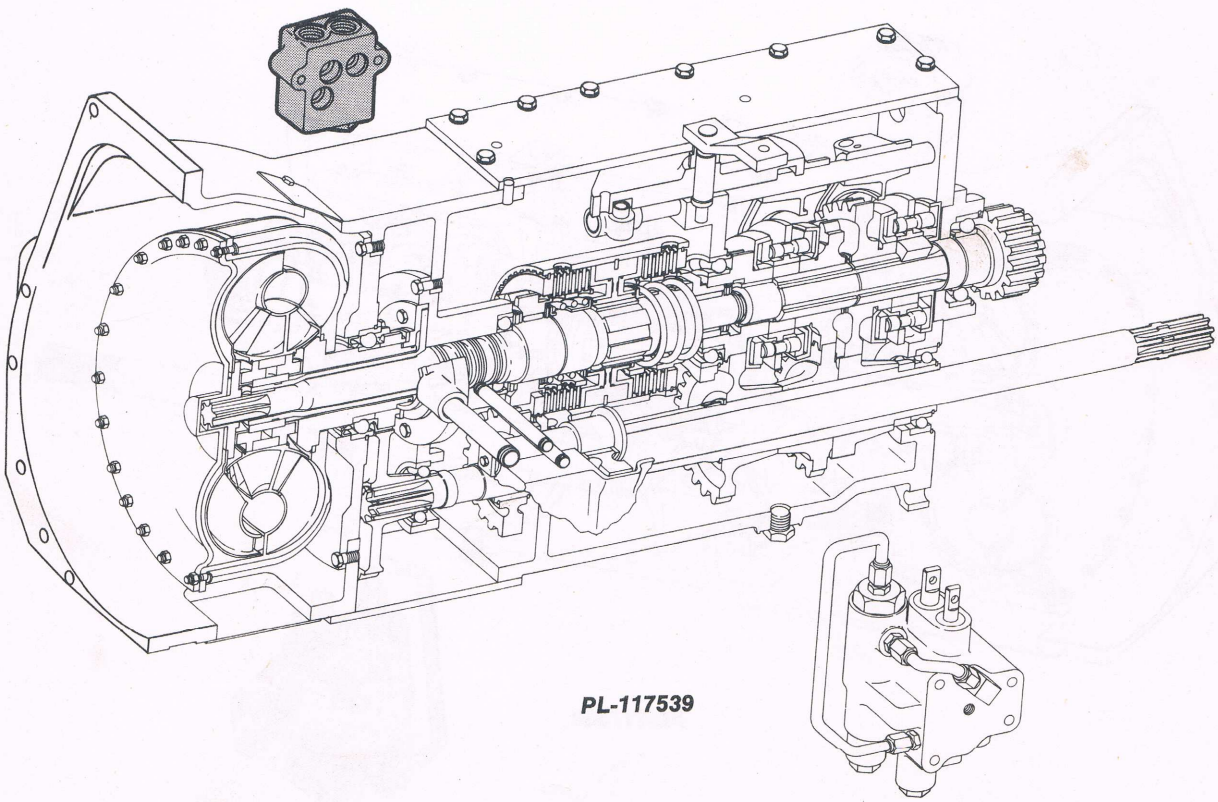

Fig. 6
Regulator Junction Valve

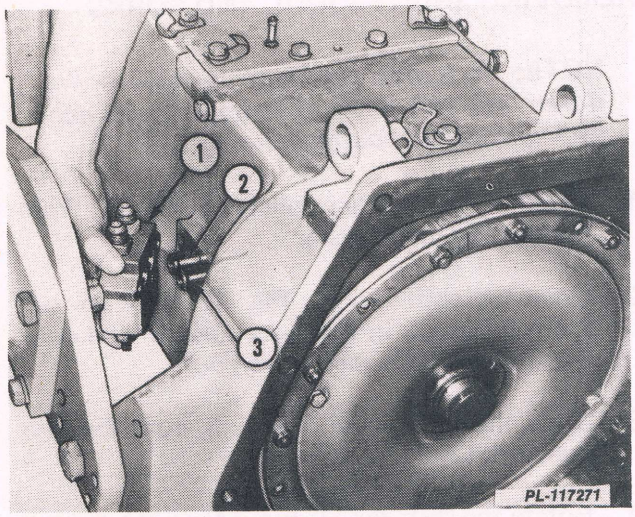

Fig. 7
Removing Regulator Junction Valve

Legend for Figure 7.

1. Regulator Junction Valve
2. Lubrication Tube
3. Torque Converter Outlet Tube

REMOVAL OF TRANSMISSION TOP COVER

1. Remove the sixteen bolts and washers securing top cover (1, Fig. 9) to transmission housing. Remove the cover and gasket (2).

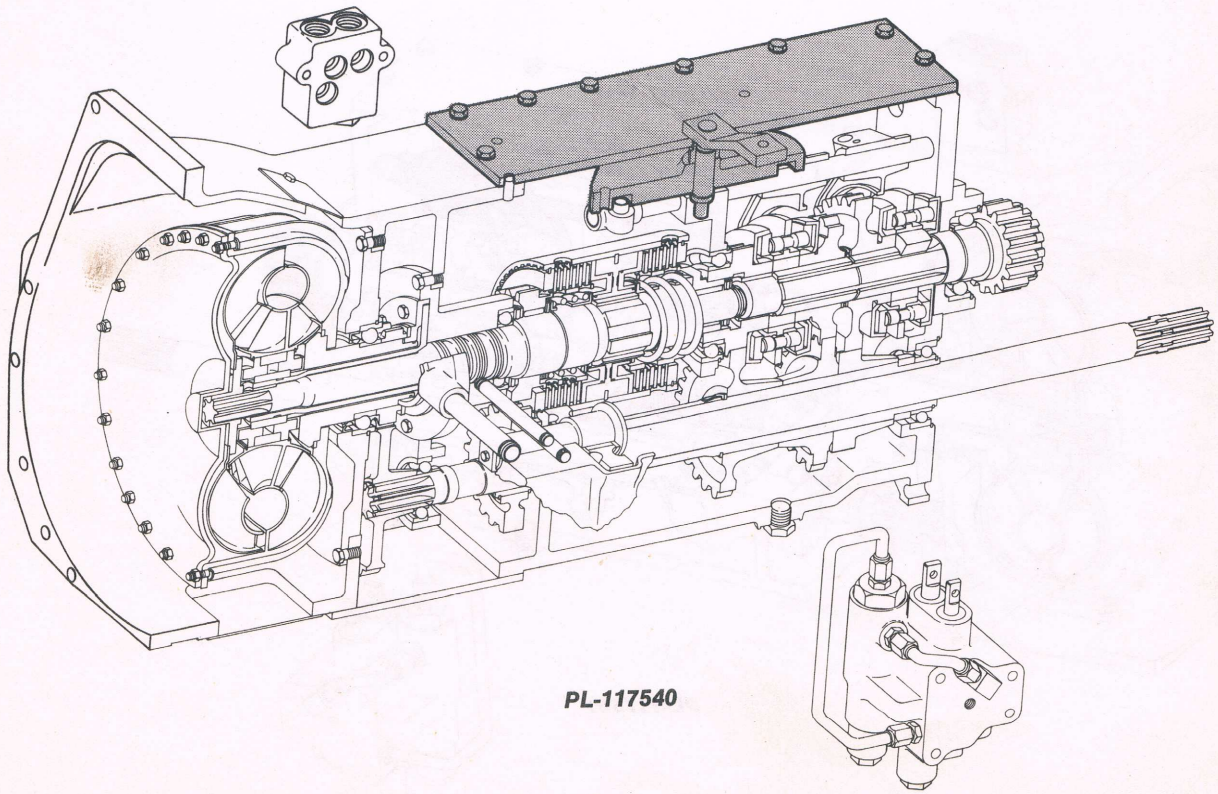

Fig. 8
Transmission Top Cover

REMOVAL OF MAJOR COMPONENTS

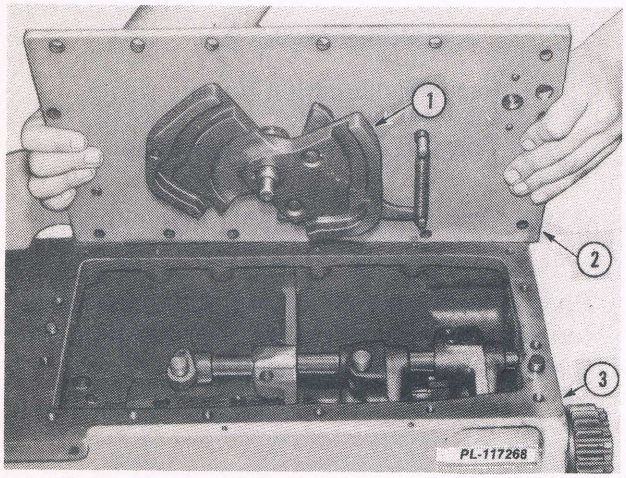

Fig. 9
Removal of Transmission Top Cover

1. Shift Cam
2. Top Cover
3. Gasket

REMOVING SHIFTER RAIL AND FORKS

NOTE: *It is not necessary to remove the shifter rail and forks to remove the clutch pack and oil distributing housing.*

1. Remove the two cam rollers (1, Fig. 11) from the shifting mechanism.
2. Move the shift rail (1, Fig. 12) back so that the roll pin (2) in first gear fork (3) will clear the first gear (4) when driven out.
3. Drive the roll pin (1, Fig. 13) from the first gear fork (2).
4. Rotate the shift rail (1, Fig. 14) so the roll pin (2) in the shift hub (3) will clear clutch pack (4) when driven out. Drive the roll pin out.
5. Pull the shift rail out the back of the transmission housing. Refer to Fig. 15.

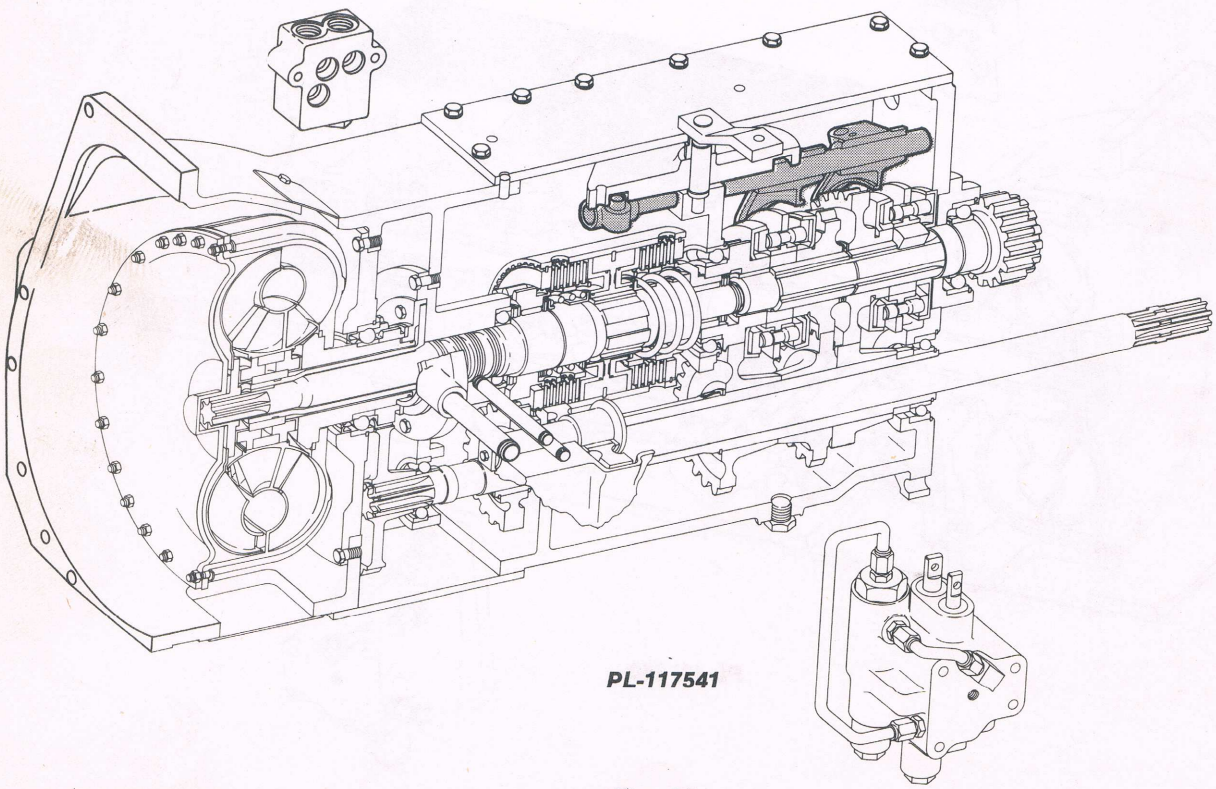

Fig. 10
Shifter Rail and Forks

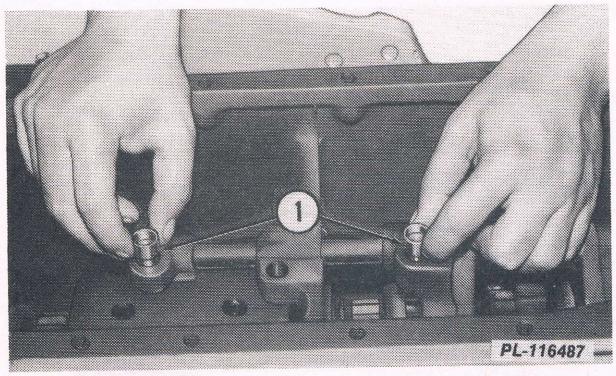

Fig. 11
Removing the Cam Rollers

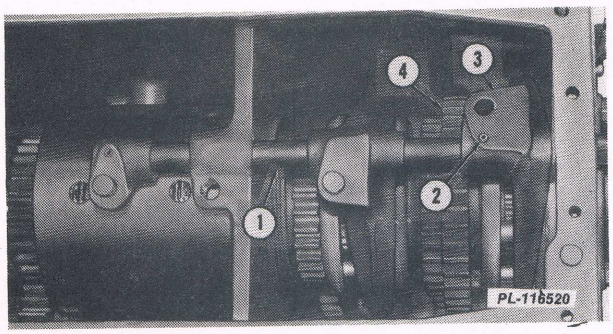

Fig. 12
Moving Shifter Rail Into Position For Removal

1. Shift Rail
2. Roll Pin
3. First Gear Fork
4. First Gear

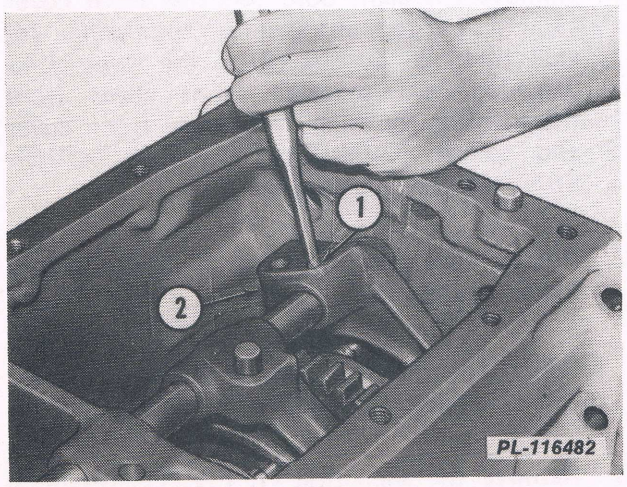

Fig. 13
Driving Roll Pin From Shift Fork

1. Roll Pin
2. First Gear Fork

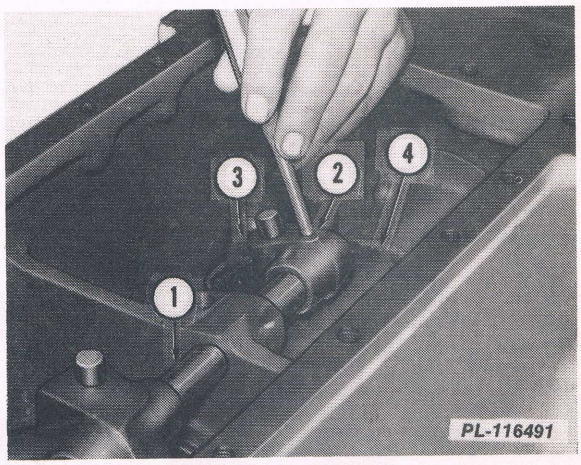

Fig. 14
Removing Shift Hub

1. Shift Rail
2. Roll Pin
3. Shift Hub
4. Clutch Pack

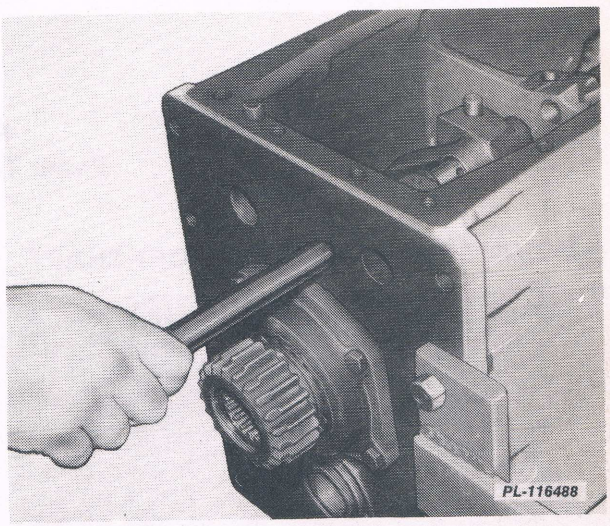

Fig. 15
Removing Shift Rail

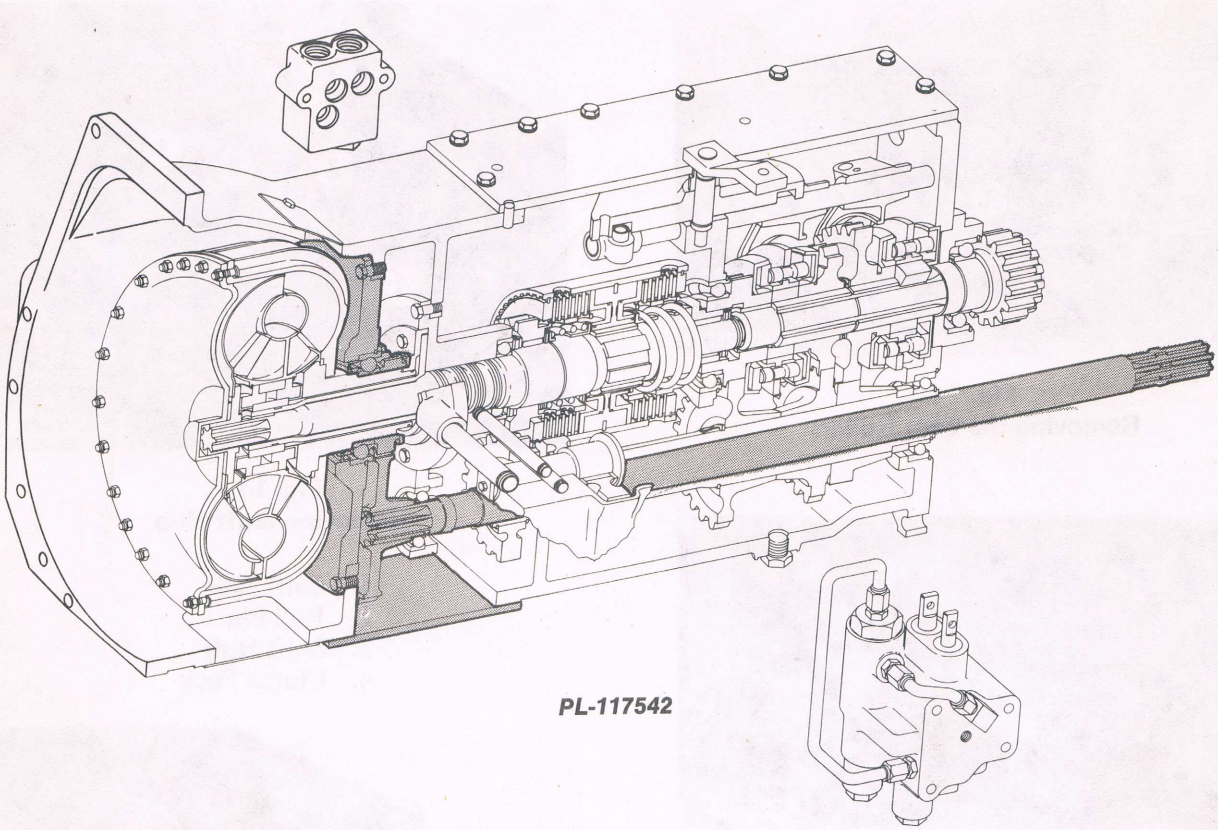

Fig. 16
Power Take Off Shaft

REMOVING THE POWER TAKE OFF SHAFT

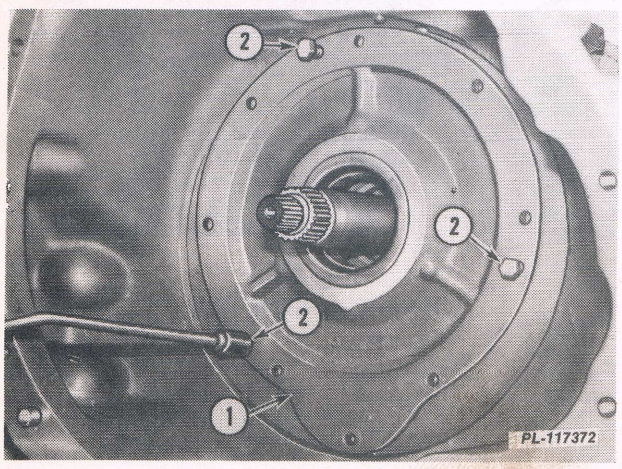

Fig. 17
Removing Front Cover Assembly

1. Front Cover Assy.
2. Jack Screws

1. Remove the eight bolts securing front cover (1, Fig. 17) to the transmission housing. Install three jackscrews (2) in the three holes provided and separate front cover from transmission housing. Remove front cover and gasket. Refer to "FRONT COVER SERVICE" in this section.

2. Remove the pto drive gear (1, Fig. 18) and spacer washer (2).

NOTE: *The pto drive gear and spacer washer sets on the lip of the oil distributing housing.*

3. Remove the snap ring (1, Fig. 19) retaining pto driven gear (2) to the pto shaft (3).

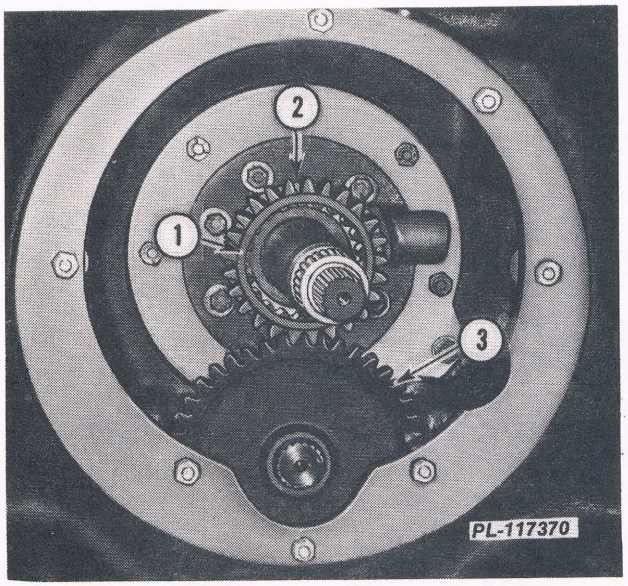

Fig. 18
Removing PTO Drive Gear

1. PTO Drive Gear
2. Spacer Washer
3. PTO Driven Gear

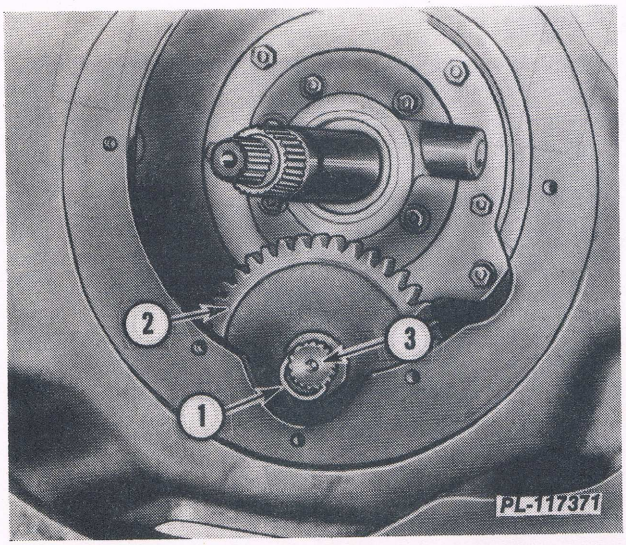

Fig. 19
Removing PTO Driven Gear

1. Snap Ring
2. PTO Driven Gear
3. PTO Shaft

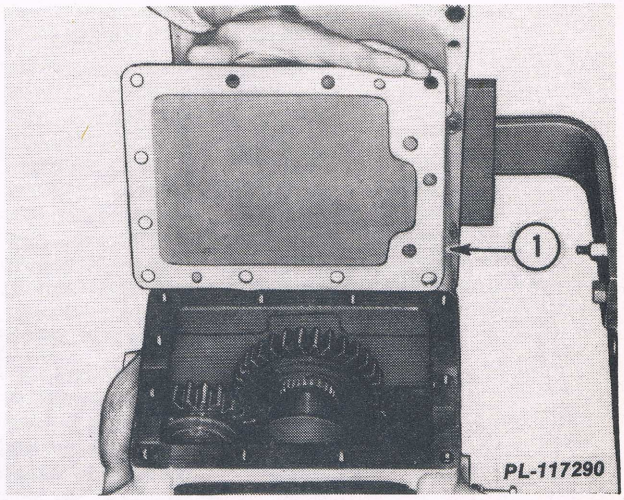

Fig. 20
Removal of Bottom Cover

REMOVING THE POWER TAKE OFF SHAFT (Continued)

3. Remove the rear bottom cover (1, Fig. 20) and gasket.

4. Drive the pto shaft back far enough to clear pto driven gear using a brass punch (Refer to Fig. 21). Leaving the punch in place for support, hold the pto driven gear through rear bottom transmission housing opening. Remove the punch and remove the pto driven gear through the opening. Remove the pto shaft from transmission.

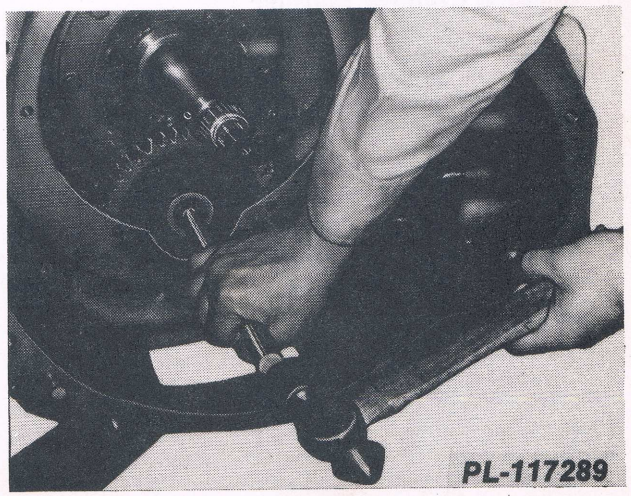

Fig. 21
Removal of PTO Driven Gear

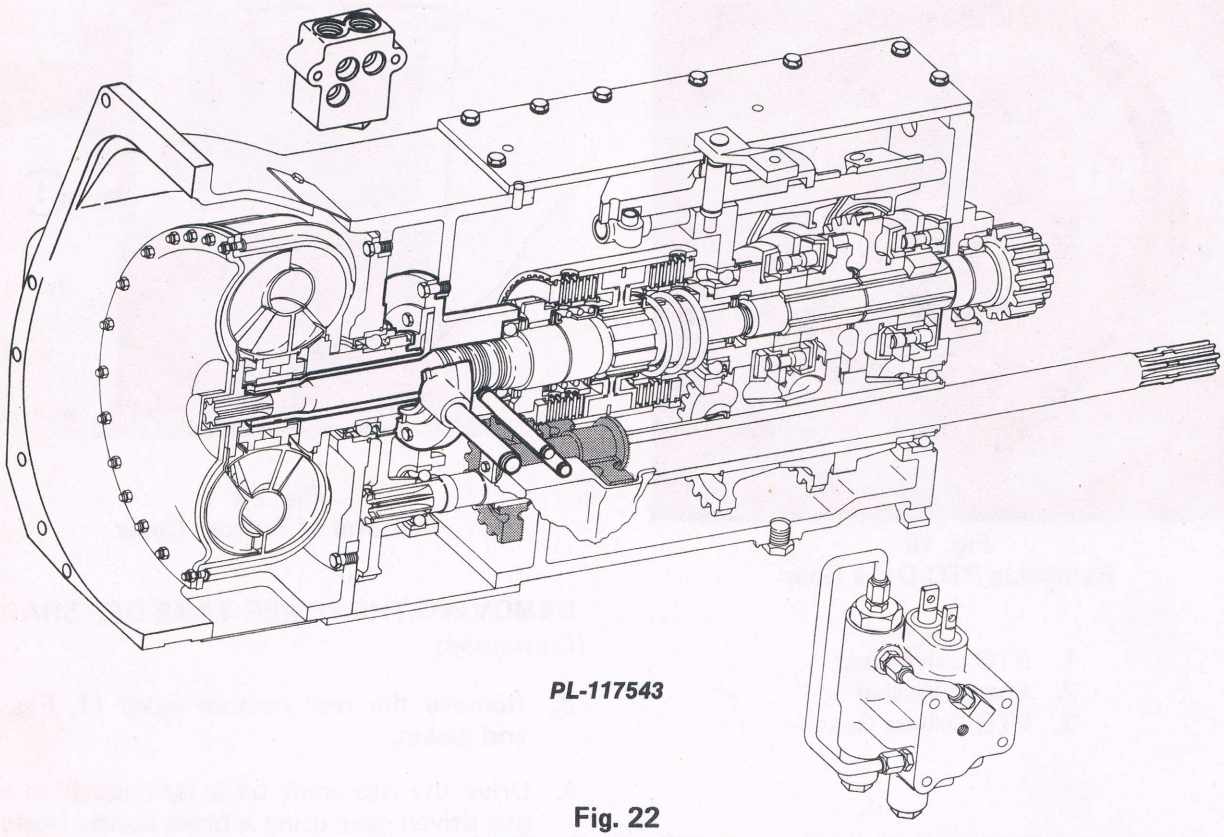

Fig. 22
Oil Distributing Housing

REMOVING THE OIL DISTRIBUTING HOUSING

1. Cover the reverse clutch pack tube (1, Fig. 23) with brass shim stock (2). Using pliers pull the tube from the housing.

   NOTE: *A drag is caused by the internal double "O" ring around the tube.*

2. Remove the forward clutch pack tube (3, Fig. 23), the torque converter inlet tube (4), the torque converter outlet tube (1, Fig. 24) and the lubrication tube (2) in the same manner.

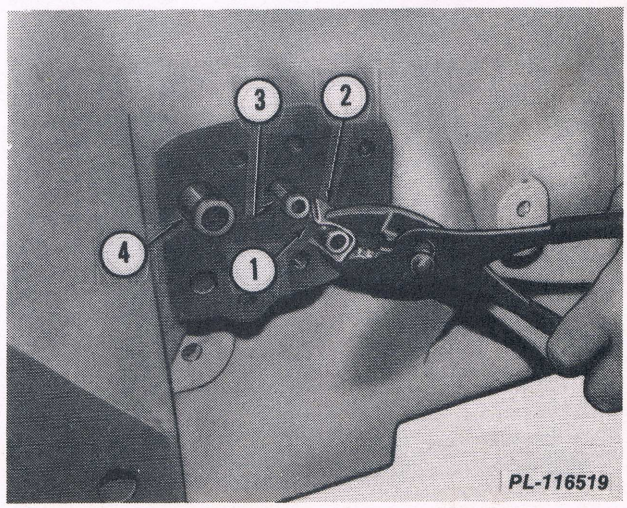

Fig. 23
Removing Reverse Clutch Pack Tube

1. Reverse Clutch Pack Tube
2. Brass Shim Stock
3. Forward Clutch Pack Tube
4. Torque Converter Inlet Tube

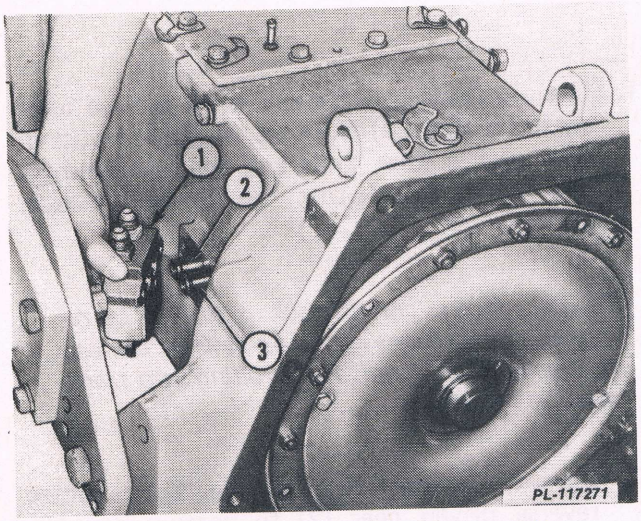

Fig. 24
Torque Converter Outlet Tube and Lubrication Tube

1. Regulator Junction Valve
2. Lubrication Tube
3. Torque Converter Outlet Tube

3. Remove the eight bolts securing oil distributing housing to transmission housing. Slide the oil distributing housing (1, Fig. 25) off the clutch pack shaft. Refer to "ON DISTRIBUTING HOUSING SERVICE" in this section.

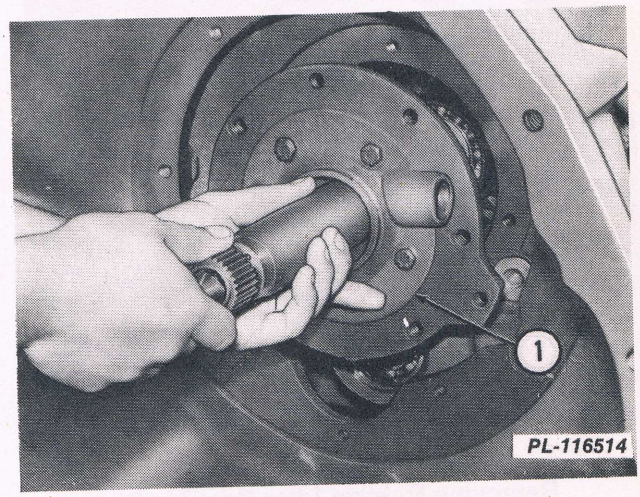

Fig. 25
Removing Oil Distributing Housing.

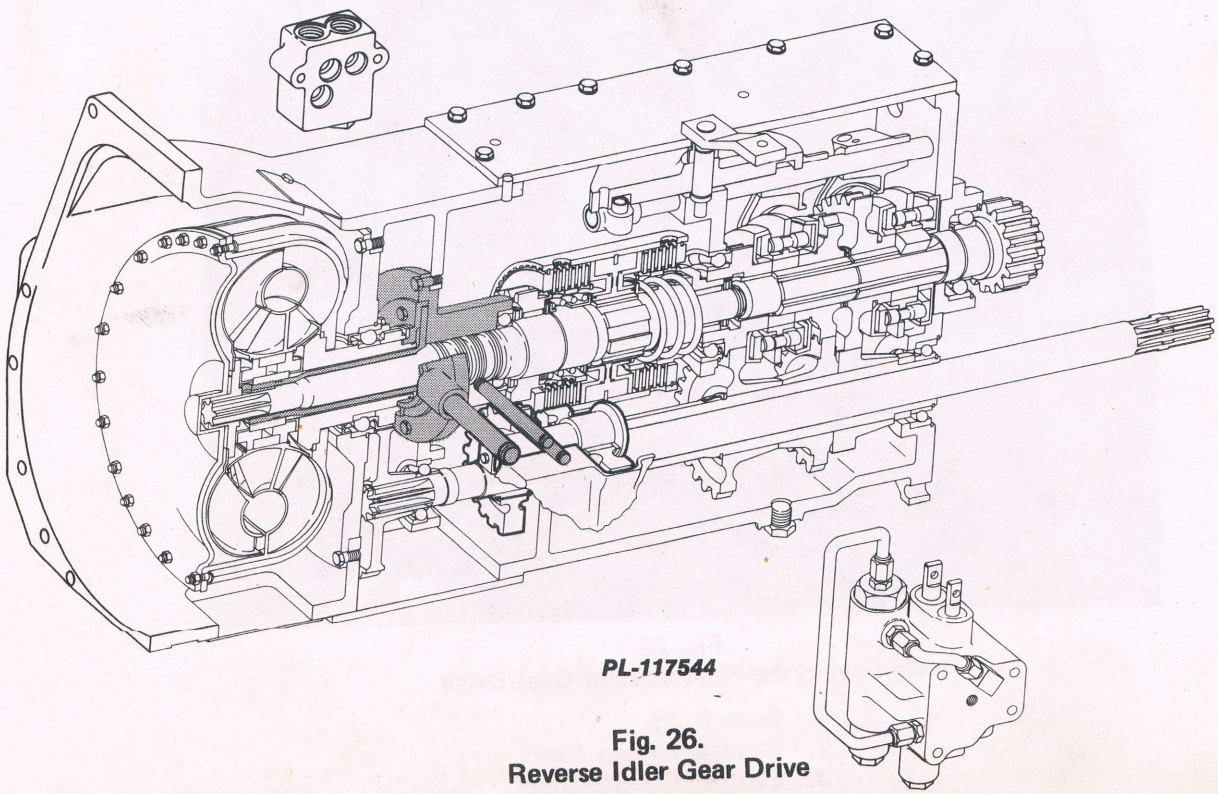

Fig. 26.
Reverse Idler Gear Drive

REMOVING THE REVERSE IDLER GEAR DRIVE

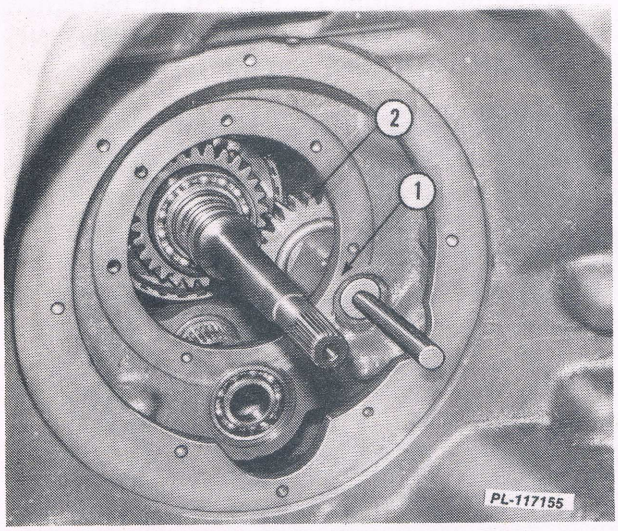

Fig. 27
Removing Reverse Idler Gear Shaft

1. Reverse Idler Shaft 2. Reverse Idler Gear

1. Using a brass drift slowly drive reverse idler shaft (1, Fig. 27) from transmission housing. The reverse idler shaft and the two washers will fall to the bottom of the transmission housing.

NOTE: *If the clutch pack is not to be removed some means are to be devised to keep reverse idler gear shaft from falling into transmission housing.*

2. Remove the snap ring (1, Fig. 28) retaining reverse driven gear (2) to bottom countershaft (3). Slide the reverse driven gear off the bottom countershaft and remove.

3. Remove the reverse idler gear (2, Fig. 27) out the bottom of the the transmission housing.

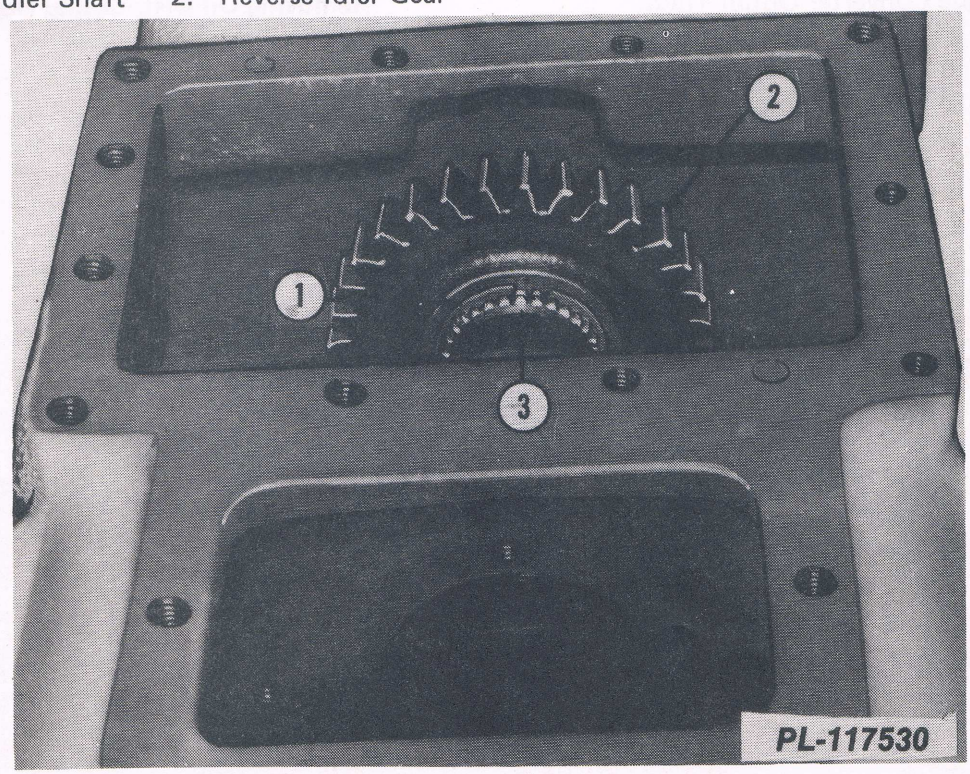

Fig. 28
Removing the Reverse Idler Gear Drive

1. Snap Ring
2. Reverse Driven Gear
3. Bottom Countershaft

REMOVAL OF CLUTCH PACK

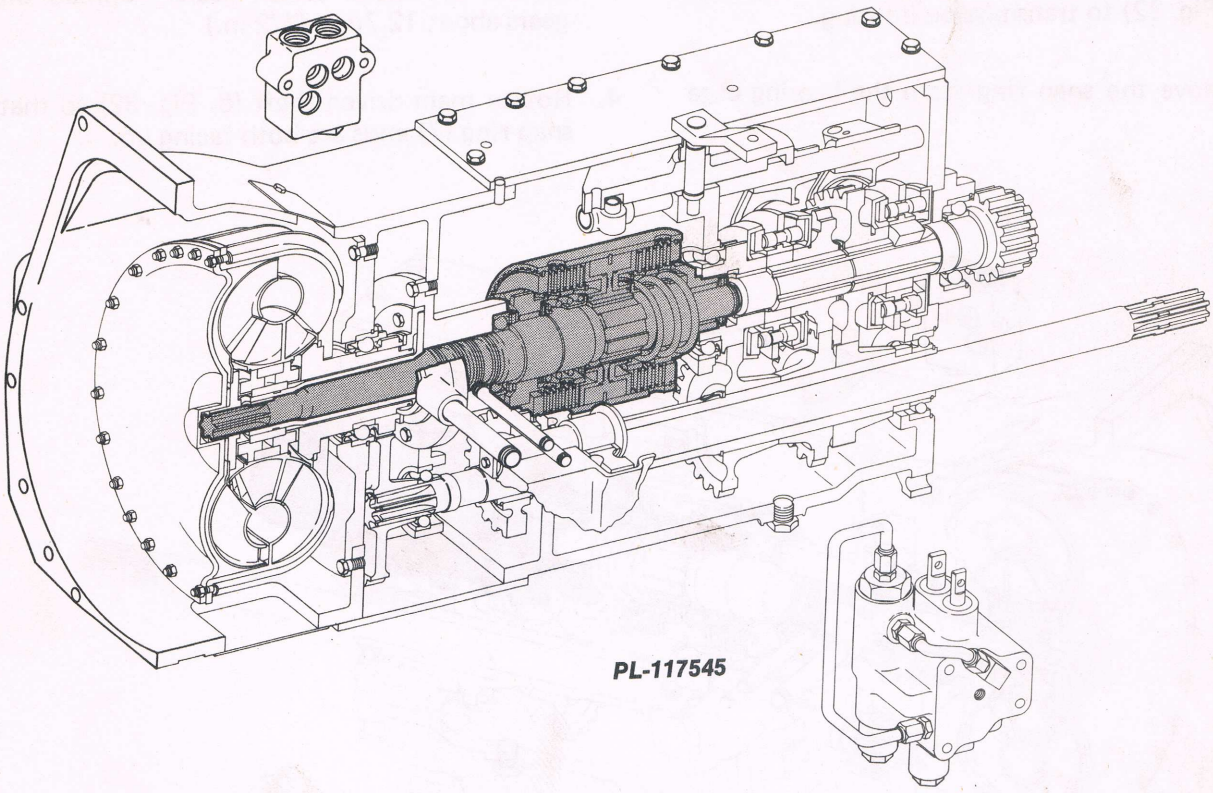

Fig. 29
Clutch Pack

1. Pull slowly and remove the clutch pack through the front opening of the transmission housing. Refer to Fig. 30. Refer to Section 4 for service procedures on clutch pack.

NOTE: *There is a lube jumper tube between the clutch pack and driven gear shaft that might come out when clutch pack is removed.*

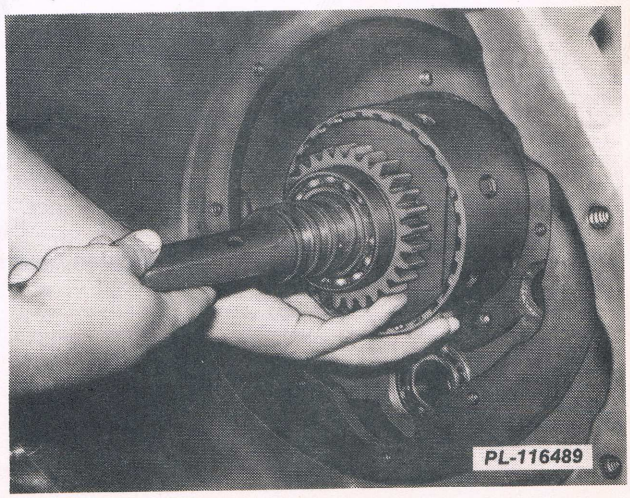

Fig. 30
Removing the Clutch Pack

REMOVAL OF TOP DRIVEN GEARS AND SYNCHRONIZERS

1. Remove the four bolts securing bearing cage (1, Fig. 32) to transmission housing.

2. Remove the snap ring from the bearing cage (1).

3. Insert a screwdriver between the first (4) and second (5) speed driven gears. Spread the gears about 12.7mm (1/2 in.)

4. Rotate main driven shaft (6, Fig. 32) so that snap ring (7) ends are both facing up.

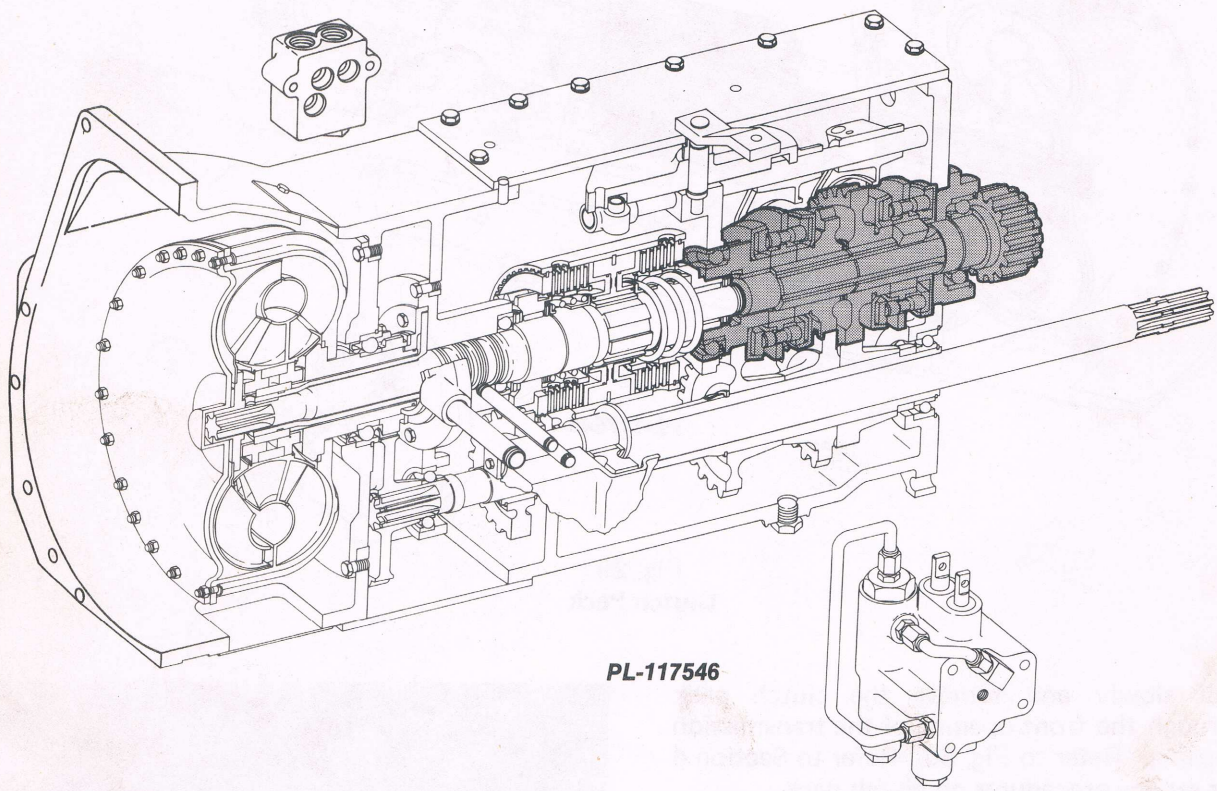

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Fig. 31
Top Driven Gears and Synchronizers

REMOVAL OF TOP DRIVEN GEARS AND SYNCHRONIZERS (Continued)

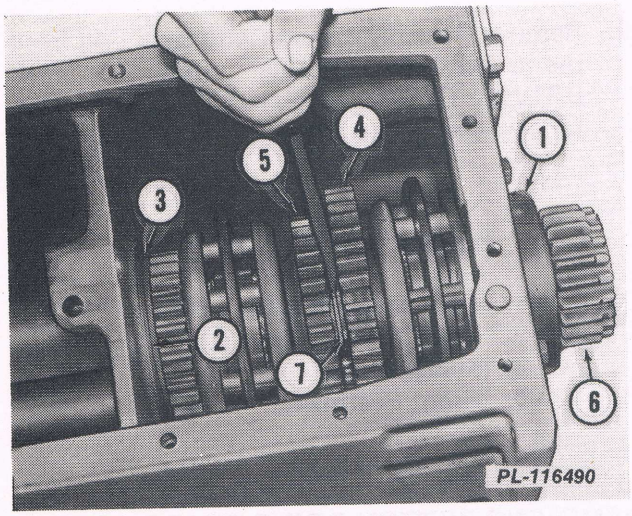

Fig. 32
Spreading First and Second Speed Driven Gears

1. Bearing Cage
2. Snap Ring
3. Front Bearing
4. First Speed Driven Gear
5. Second Speed Driven Gear
6. Main Driven Shaft
7. Snap Ring

5. Using two screwdrivers remove the snap ring from the main driven shaft. Refer to Fig. 33.

   NOTE: *The snap ring (4) is serviced only as part of bearing (3). Be careful not to damage snap ring when removing the bearing.*

6. Remove the main driven shaft through the rear of the transmission housing.

7. Raise the first speed driven gear (1, Fig. 34) and synchronizer (2) from the transmission housing.

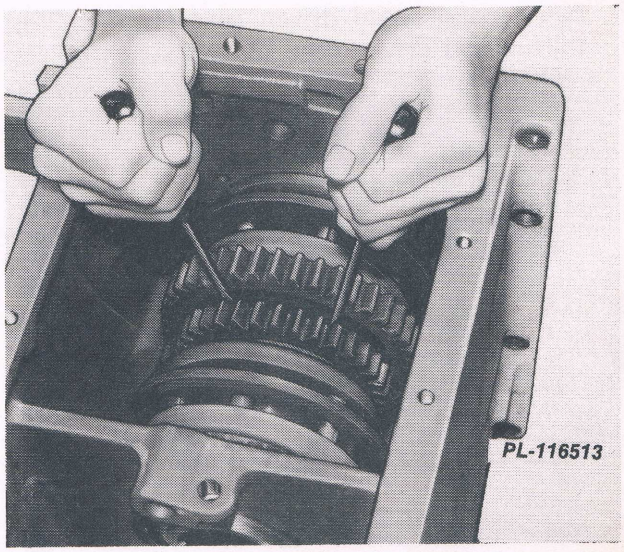

Fig. 33
Removing Snap Ring

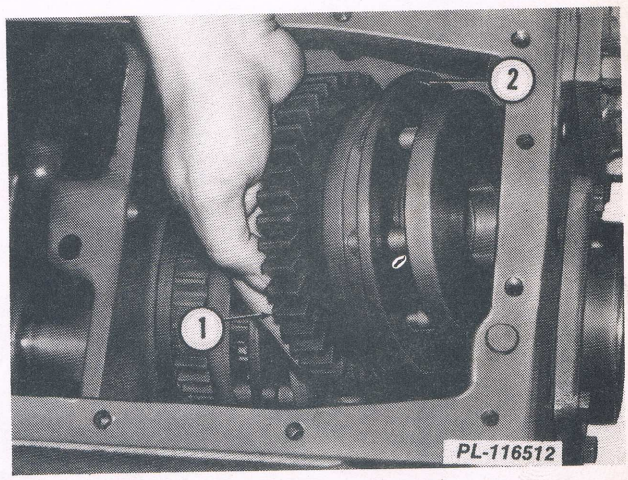

Fig. 34
Removing First Speed Driven Gear and Synchronizer

1. First Speed Driven Gear
2. Synchronizer

(continued on next page)

REMOVAL OF TOP DRIVEN GEARS AND SYNCHRONIZERS (Continued)

8. Pull second speed driven gear (1, Fig. 35), third speed driven gear (2) and synchronizer (3) away from front bearing (4) and raise from the transmission housing.

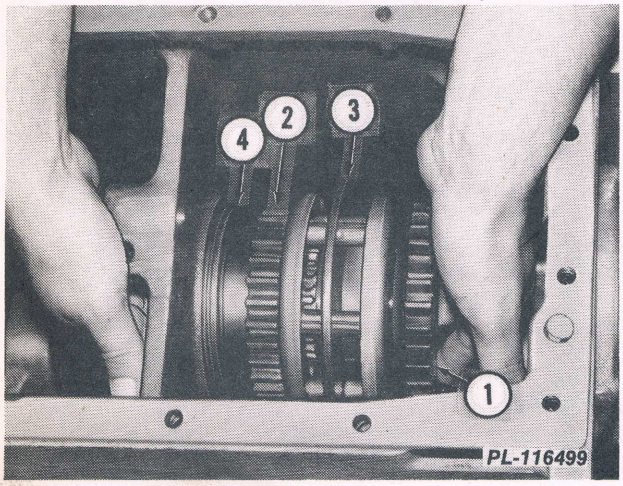

Fig. 35
Removing second and Third Speed Driven Gears and Synchronizer

9. Remove the front bearing with snap ring from the transmission housing. Refer to "TOP DRIVEN GEARS SERVICE" in this section for servicing procedures.

Legend for Figure 35.

1. Second Speed Driven Gear
2. Third Speed Driven Gear
3. Synchronizer
4. Front Bearing

REMOVING BOTTOM DRIVE GEARS

1. Remove the snap ring (1, Fig. 37) from the bottom countershaft (2).

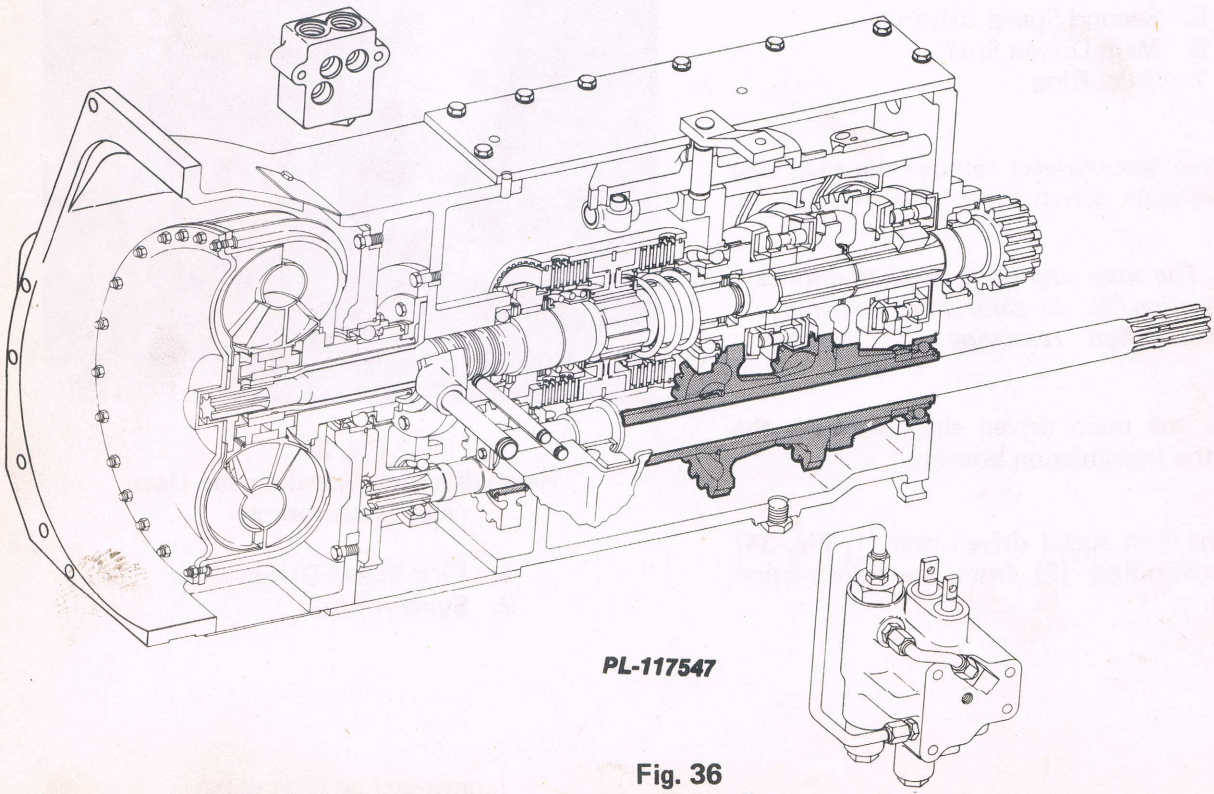

Fig. 36
Bottom Drive Gears

REMOVING BOTTOM DRIVE GEARS (Continued)

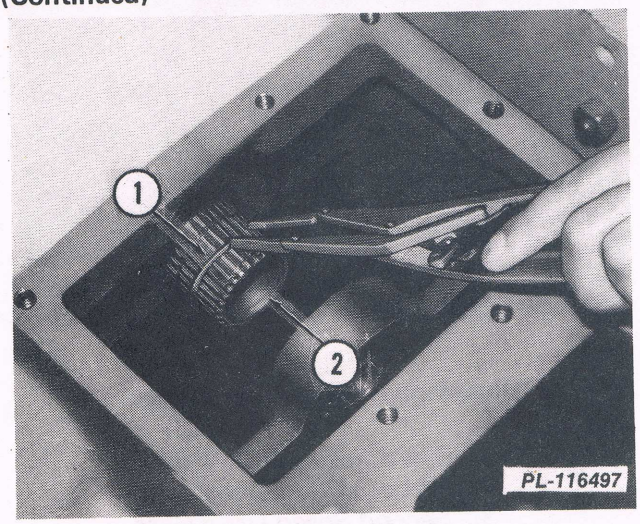

Fig. 37
Removing Snap Ring

1. Snap Ring
2. Bottom Countershaft

2. Remove bottom countershaft bearing outer snap ring (1, Fig. 38).

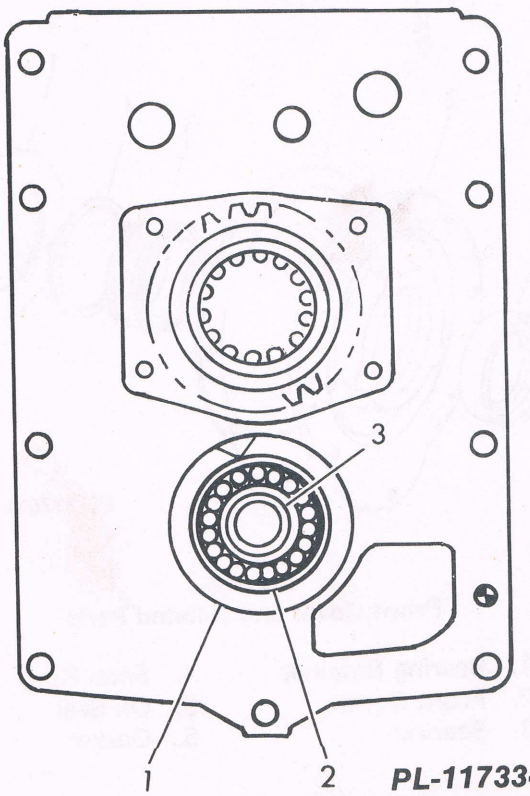

Fig. 38
Outer Bearing Snap Ring

Legend for Figure 38.

1. Snap Ring
2. Bearing
3. Bottom Countershaft

3. Release the snap ring (1, Fig. 39) securing drive gears (2) to the bottom countershaft (3). Work the snap ring down the bottom countershaft to where shown (4).

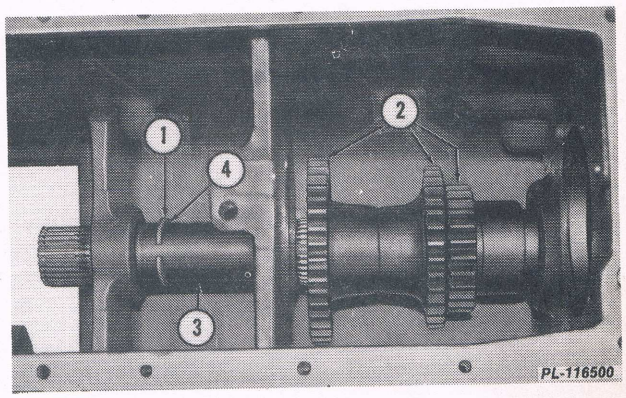

Fig. 39
Bottom Countershaft and Drive Gears

1. Snap Ring
2. Drive Gears
3. Countershaft
4. Position to Move Snap Ring

4. Pull countershaft out to where shown in Fig. 40. Remove snap ring from countershaft.

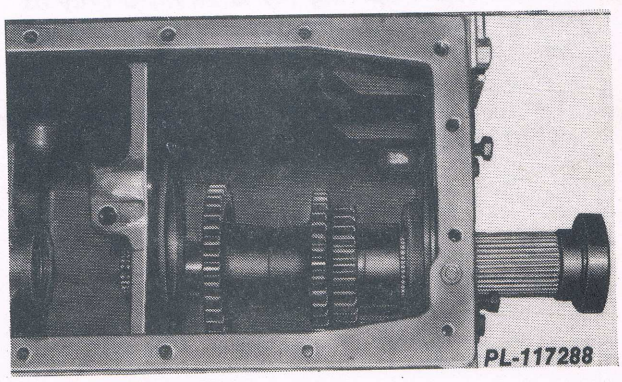

Fig. 40
Bottom Countershaft Position for Removing Snap Ring

(continued on next page)

REMOVING BOTTOM DRIVE GEARS (Continued)

5. Holding onto to third speed drive gear (1, Fig. 41) slide bottom countershaft (2) until clear of third speed drive gear. Remove the gear. Remove second speed drive gear (3) and first speed drive gear (4) in the same manner. Remove the spacer bushing (5) with the countershaft.

Refer to "BOTTOM DRIVE GEARS SERVICE" in this section for servicing procedures.

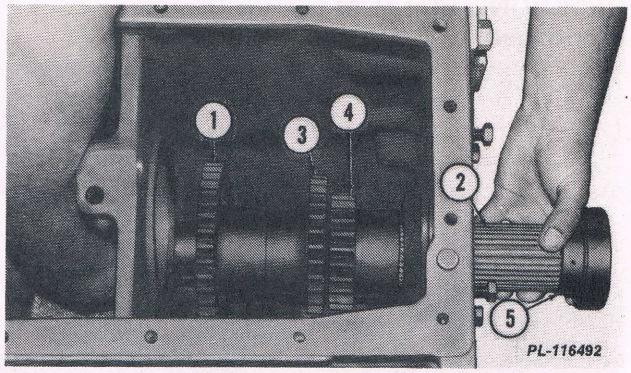

Fig. 41
Removing Bottom Countershaft

1. Third Speed Drive Gear
2. Bottom Countershaft
3. Second Speed Drive Gear
4. First Speed Drive Gear
5. Spacer Bushing

FRONT COVER SERVICE

DISASSEMBLY (Refer to Fig. 42)

1. Remove the bearing retainer (1) from back of front cover (2).

2. Remove the bearing (3) with snap ring (4) from front cover.

   NOTE: *The snap ring (4) is serviced only as part of bearing (3). Be careful not to damage snap ring when removing the bearing.*

3. Remove the oil seal (5) and gasket (6) from front cover.

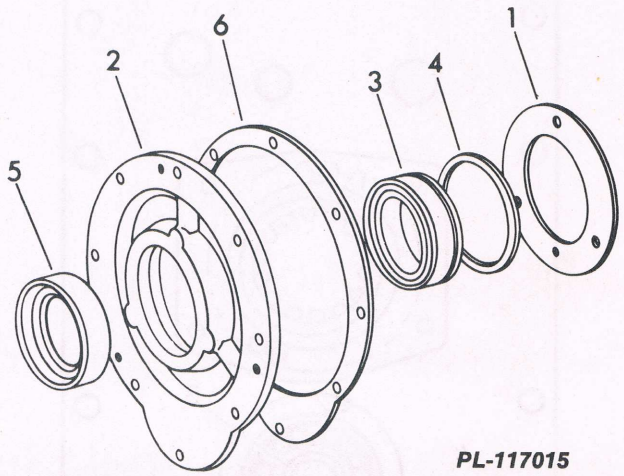

Fig. 42
Front Cover and Related Parts

1. Bearing Retainer
2. Front Cover
3. Bearing
4. Snap Ring
5. Oil Seal
6. Gasket

FRONT COVER SERVICE

INSPECTION AND REPAIR

1. Discard the gasket and oil seal and replace with new.
2. Clean the metal parts in a suitable solvent. Never use a caustic solution. Dry the parts with compressed air.

NOTE: *Do not spin the bearings before or during cleaning or until it is properly lubricated to prevent damaging them.*

3. Inspect the bearings for metal flaking, cracks, scoring, nicks or excessive wear. If the bearing appears to have been over-heated, inspect for cause, such as dirt or lack of lubrication. Serviceable bearings should be adequately lubricated and enclosed in a lint-free wrapper until installed.
4. Inspect cast parts for cracks. Replace cracked parts. Inspect all bearing bores and mounting faces for wear, grooves, and scratches. Remove burrs and scratches with a crocus cloth. Inspect tapped holes for damaged threads. Repair or replace as necessary.

REASSEMBLY (Refer to Fig. 42)

1. Install oil seal (5) into front cover (2) as illustrated in Fig. 43).
2. Install bearing (3) into front cover until it bottoms.
3. Install the bearing retainer (1) with three bolts to front cover.

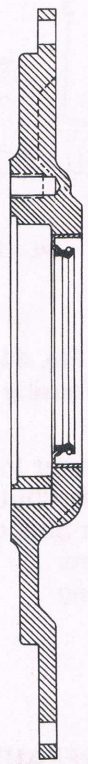

Fig. 43
Oil Seal Installed in Front Cover

OIL DISTRIBUTING HOUSING SERVICE

DISASSEMBLY (Refer to Fig. 44)

1. Remove the six bolts securing converter inlet cover (1) to oil distributing housing (2).
2. Separate converter inlet cover from stator support shaft (3) and oil distributing housing.
3. Separate stator support shaft from oil distributing housing.
4. Remove and discard both gaskets (4).
5. If necessary remove the bus (5) from stator support shaft and discard.

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OIL DISTRIBUTING HOUSING SERVICE

DISASSEMBLY (Continued)

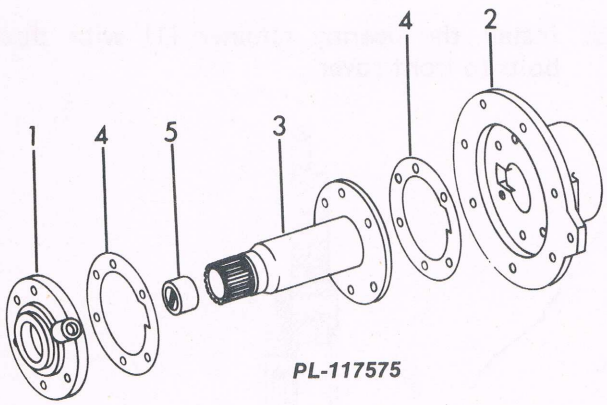

Fig. 44
Oil Distriubting Housing and Related Parts

1. Converter Inlet Port
2. Oil Distributing Housing
3. Stator Support Shaft
4. Gaskets
5. Bushing

INSPECTION AND REPAIR

1. Discard all gaskets, oil seals, "O" rings, snap rings and piston rings and replace with new.

2. Clean the metal parts in a suitable solvent. Never use a caustic solution. Dry the parts with compressed air. Be sure that oil passages and other openings are clean and not plugged.

3. Inspect cast parts for cracks. Replace cracked parts. Inspect all bearing bores and mounting faces for wear, grooves and scratches. Remove burrs and scratches with a crocus cloth. Inspect tapped holes for damaged threads. Repair or replace as necessary.

4. Inspect all splined parts for worn, twisted, nicked or burred splines. If possible remove defects with a soft stone. Replace parts as necessary.

5. Inspect threaded parts for damaged threads. Repair threads by chasing or filing with a fine three cornered file. Replace when repair cannot be satisfactorily accomplished.

6. Inspect gear teeth for damage. Repair minor burrs or nicks with a fine file or emery cloth.

7. Flush out the oil passages in the transfer case. Be sure all lube holes are clean and free of obstruction.

REASSEMBLY (Refer to Fig. 44)

1. If necessary install new bushing (5) to stator support shaft (3).

2. Install gasket (4) into oil distributing housing (2).

3. Install stator support shaft (3) into housing (2) and install second gasket (4) onto stator support shaft.

4. Place converter inlet port (1) over shaft, align holes through assembly and install six bolts.

TOP DRIVEN GEARS SERVICE

INSPECTION AND REPAIR (Refer to Fig. 45)

1. Discard snap rings (2, 9 and 15) and replace with new.

2. Clean all parts in a commerical solvent and dry with compressed air. Be sure that oil passages and other openings are clean and not plugged.

IMPORTANT: Do not use compressed air to spin dry the bearings.

3. Inspect shaft bearings (1, 4 and 14) and cage bearing (13) for flaking, cracks, scoring, nicks or excessive wear. Replace if necessary.

4. Inspect spline parts for worn, twisted, nicks or burred splines. If possible remove defect

INSPECTION AND REPAIR (Refer to Fig. 45) Continued

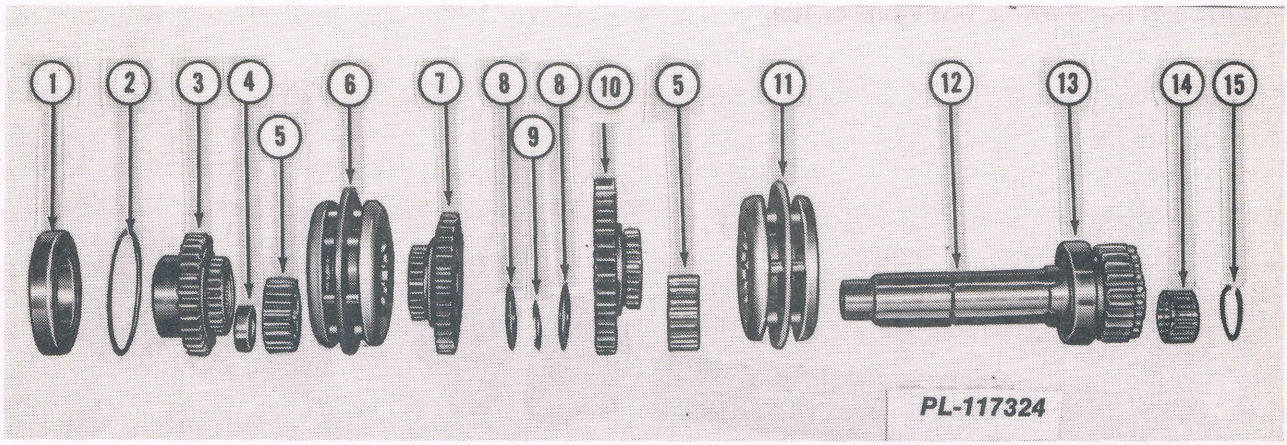

Fig. 45
Top Driven Gears

1. Ball Bearing
2. Inner Snap Ring
3. Direct Forward Drive Hub Gear
4. Needle Bearing
5. Speed Shift Hub
6. 2nd and 3rd Speed Synchronizer Assembly
7. 2nd Speed Driven Gear
8. Thrust Washer
9. Snap Ring
10. 1st Speed Driven Gear
11. 1st Speed Synchronizer Assembly
12. Main Shaft
13. Cage Bearing
14. Needle Bearing
15. Snap Ring

with a fine stone or file, otherwise replace.

5. Inspect gear teeth for damage. Remove minor burrs and nicks with a fine stone or file.

6. Inspect synchronizers (6 and 11) for wear and damage, replace if necessary.

BOTTOM DRIVE GEARS SERVICE

INSPECTION AND REPAIR (Refer to Fig. 46)

1. Discard snap rings (1, 7, 8 and 10) and replace with new.

2. Clean all parts in a commercial solvent and dry with compressed air. Be sure that oil passages and other openings are clean and not plugged.

IMPORTANT: Do not use compressed air to spin dry the bearings.

3. Inspect shaft bearing (2) for flaking, cracks, scoring, nicks or excessive wear. Replace if necessary.

4. Inspect spline parts for worn, twisted, nicked or burred splines. If possible remove defect with a fine stone or file, otherwise replace.

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INSPECTION AND REPAIR (Continued)

5. Inspect gear teeth for damage. Remove minor burrs and nicks with a fine stone or file.

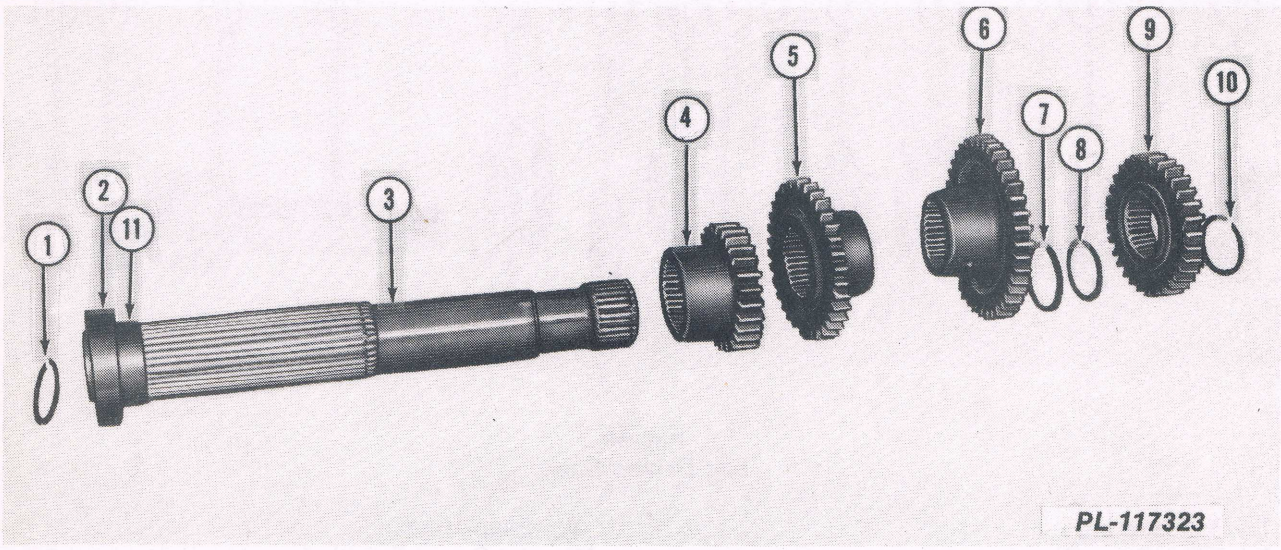

Fig. 46
Bottom Drive Gears

1. Snap Ring
2. Countershaft Ball Bearing
3. Countershaft
4. 1st Speed Drive Gear
5. 2nd Speed Drive Gear
6. Constant Mesh Driven Gear
7. Snap Ring
8. Snap Ring
9. Reverse Driven Gear
10. Snap Ring
11. Shaft Spacer Bushing

INSTALLATION OF MAJOR COMPONENTS

INSTALLING BOTTOM DRIVE GEARS

1. If removed, install spacer bushing (5, Fig. 47) and bearing to bottom countershaft (2). Slide bottom countershaft into transmission housing.

2. Place the first speed drive gear (4, fig. 47) in transmission housing. Slide bottom countershaft (2) through the gear until the gear is supported by shaft. Install the second speed drive gear (3) and third speed drive gear (1) in the same manner.

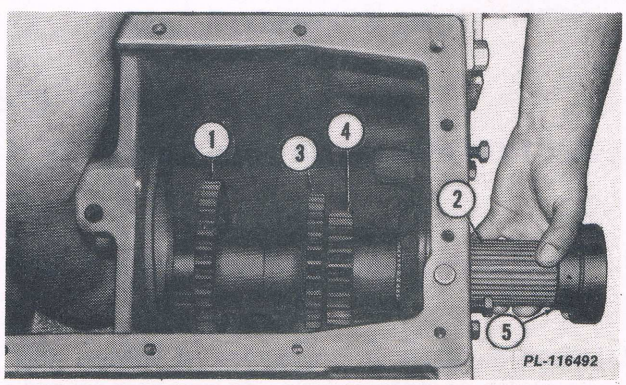

Fig. 47
Installing Bottom Countershaft

INSTALLING BOTTOM DRIVE GEARS (Continued)

Legend for Figure 47.

1. Third Speed Drive Gear
2. Bottom Countershaft
3. Second Speed Drive Gear
4. First Speed Drive Gear
5. Spacer Bushing

3. Move countershaft in position as shown in Fig. 48. Install snap ring onto countershaft.

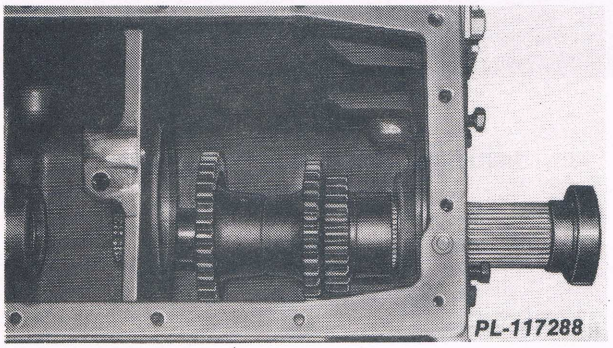

Fig. 48
Bottom Countershaft Position for Installing Snap Ring

4. Move countershaft in until bearing (2, Fig. 49) bottoms in transmission housing. Install snap ring (1, Fig. 49) and snap ring (1, Fig. 50).

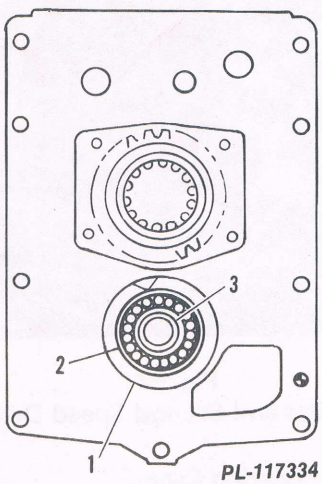

Fig. 49
Outer Bearing Snap Ring

1. Snap Ring
2. Bearing
3. Bottom Countershaft

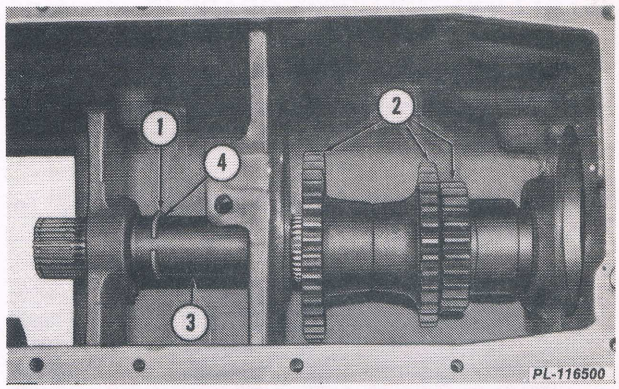

Fig. 50
Bottom Countershaft and Drive Gears

5. Install snap ring (1, Fig. 51) to countershaft.

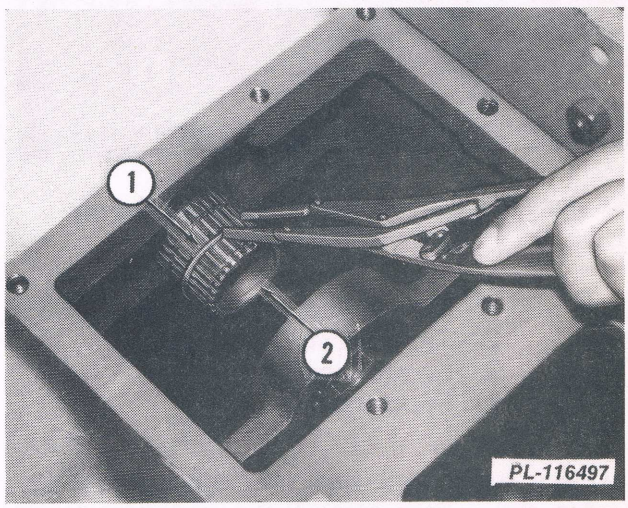

Fig. 51
Installing Snap Ring

1. Snap Ring
2. Bottom Countershaft

INSTALLING TOP DRIVE GEARS

1. Mount bearing cage (1, Fig. 54) to transmission housing using four bolts.

2. Install front bearing (4, Fig. 52) with snap ring to transmission housing.

3. Install the third speed driven gear (2, Fig. 52) to the front bearing.

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INSTALLING TOP DRIVE GEARS (Continued)

4. Place speed shift hub into synchronizer and install synchronizer to third speed gear (3, Fig. 52).

5. Install second speed driven gear (1, Fig. 52) to synchronizer (3).

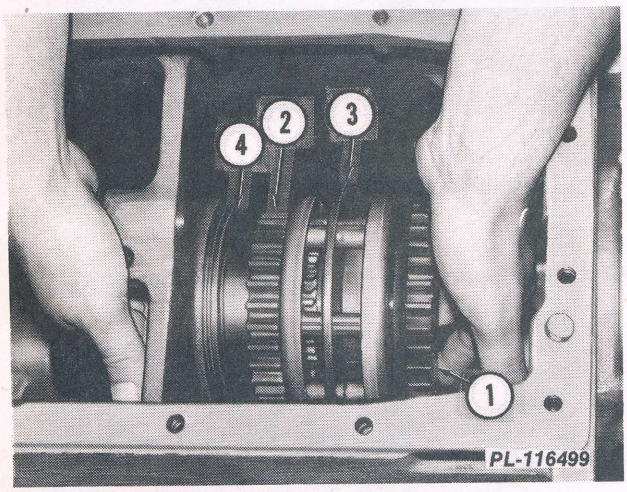

Fig. 52
Installing Second and Third Speed Driven Gear and Synchronizer

1. Second Speed Driven Gear
2. Third Speed Driven Gear
3. Synchronizer
4. Front Bearing

6. Place speed shift hub into synchronizer (2, Fig. 53). Then place first speed driven gear (1) into synchronizer and lower into transmission housing.

7. Install the main drive shaft through the rear of the transmission until it just clears the first speed gear. Place two thrust washers between first speed gear and second speed gear, move main drive shaft until bearing bottoms in bearing cage (1, Fig. 54).

8. Install snap ring (7, Fig. 54) between thrust washers.

IMPORTANT: Be careful not to damage the thrust washers when installing snap ring.

9. Install snap ring to bearing cage (1, Fig. 54).

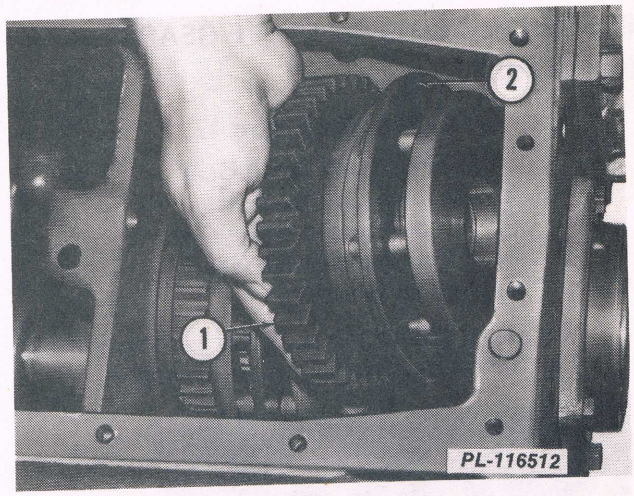

Fig. 53
Installing First Speed Driven Gear and Synchronizer

1. First Speed Driven Gear
2. Synchronizer

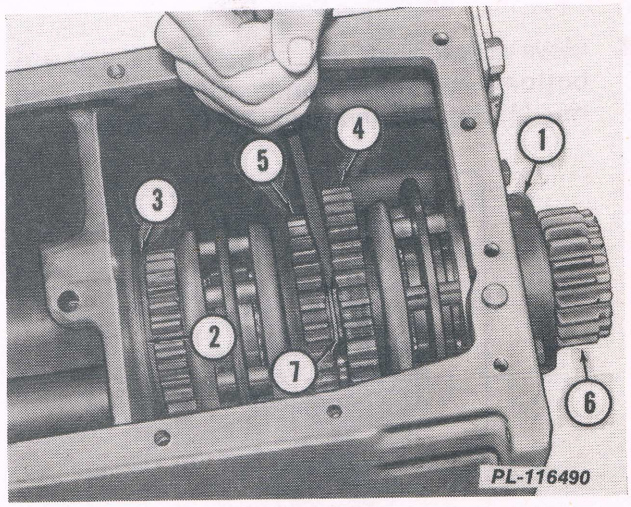

Fig. 54
Spreading First and Second Speed Driven Gears

1. Bearing Cage
2. Snap Ring
3. Front Bearing
4. First Speed Driven Gear
5. Second Speed Driven Gear
6. Main Driven Shaft
7. Snap Ring

INSTALLING OF CLUTCH PACK

1. Install the lube jumper tube in the driven gear shaft.

2. Install the clutch pack through the front opening as shown in Fig. 55, until it is seated in place.

IMPORTANT: Do not damge the lube jumper tube while installing the clutch pack.

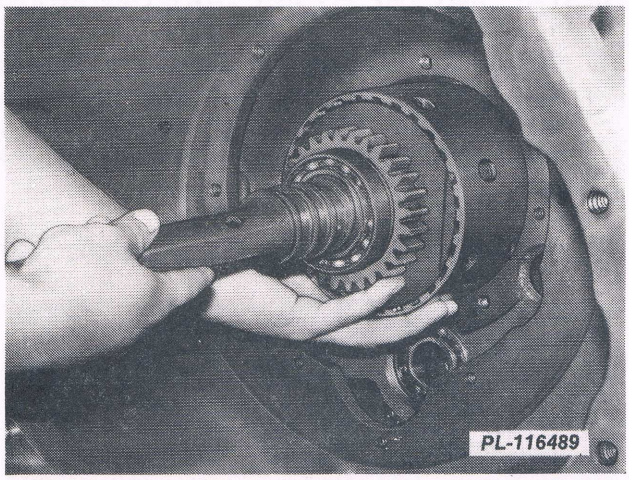

Fig. 55
Installing the Clutch Pack

INSTALLING REVERSE IDLER GEAR

1. Install needle bearing to reverse idler gear.

2. Place a bolt (3/8-16 thread approximately 7 inches long) (3, Fig. 56) through the gear mounting opening in the transmission housing. Place one washer on the bolt inside the transmission housing, then place the reverse idler gear (1) and the second washer on the bolt. Next place the fast reverse idler shaft (2) in the housing and thread it to the bolt. Pull the bolt until the shaft is through the housing wall as shown in Fig. 56. Remove bolt when shaft is in place.

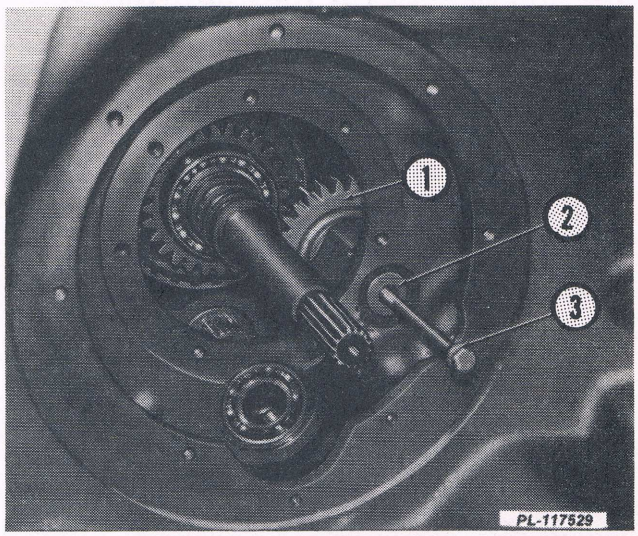

Fig. 56
Installing Fast Reverse Idler Gear

1. Fast Reverse Idler Gear
2. Fast Reverse Idler Shaft
3. Bolt

NOTE: *The reverse idler shaft will not be secured in place until the oil distributing housing is installed.*

INSTALLING THE OIL DISTRIBUTING HOUSING

1. Slide the oil distributing housing onto the clutch pack shaft and align as shown in Fig. 57. Install eight bolts securing the oil distributing housing to the transmission housing.

NOTE: *Be sure that when mounting the oil distributing housing that the bolt is 1-3/4 inches long and lock washers are used to secure the fast reverse idler shaft.*

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INSTALLING THE OIL DISTRIBUTING HOUSING (Continued)

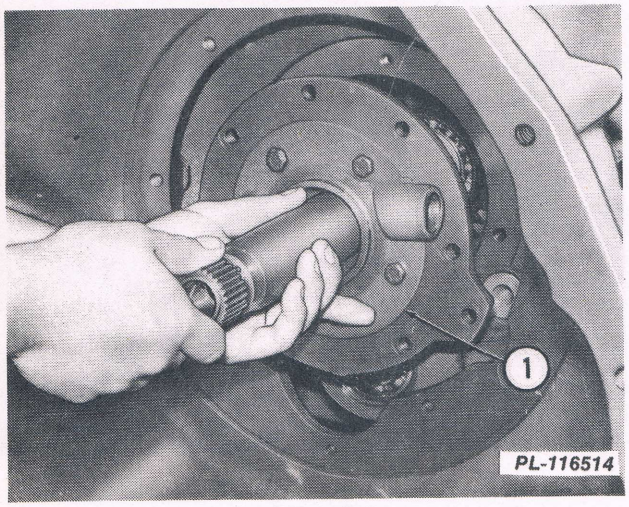

Fig. 57
Installing Oil Distributing Housing

2. When installing the clutch pack tube (7, Fig. 68) use new "O" rings. Coat the tube with petroleum jelly and place the double "O" ring side into the housing, tap lightly into place using a rubber hammer.

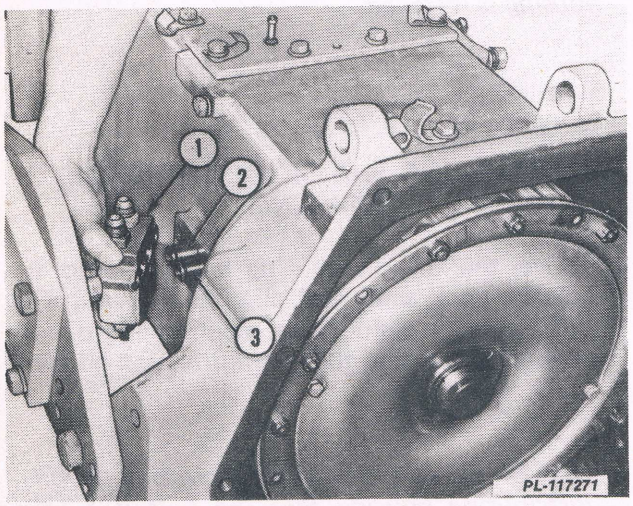

Fig. 58
Torque Converter Outlet Tube and Lubrication Tube

Legend for Figure 58.

1. Regulator Junction Valve
2. Lubrication Tube
3. Torque Converter Outlet Tube

3. Install the forward clutch pack tube (6), torque converter inlet tube (5), torque converter outlet tube (1, Fig. 58) and the lubrication tube (2) in the same manner.

INSTALLING THE POWER TAKE OFF SHAFT

1. Install pto shaft from the rear of the transmission, until it clears the front opening. Place the pto driven gear through the rear bottom housing opening and slide pto shaft through gear.

2. Install snap ring (1, Fig. 59) to pto shaft (3).

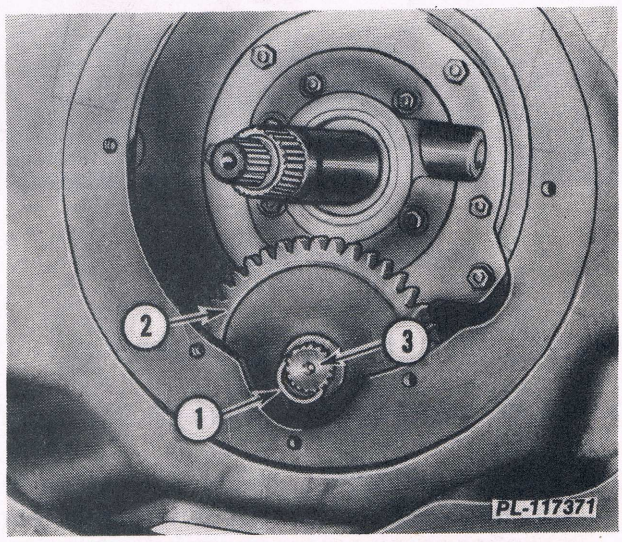

Fig. 59
Installing PTO Driven Gear

1. Snap Ring
2. PTO Driven Gear
3. PTO Shaft

3. Install the rear bottom cover (1, Fig. 60) and new gasket.

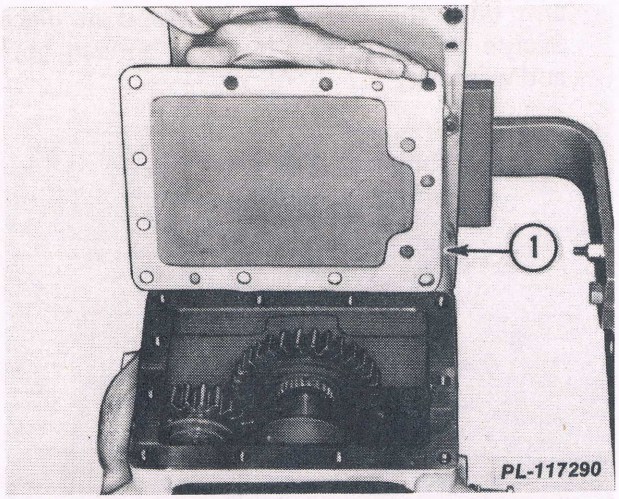

Fig. 60
Installing Bottom Cover

4. Install the spacer washer (2, Fig. 61) and the pto drive gear (1) onto the lip of the oil distributing housing.

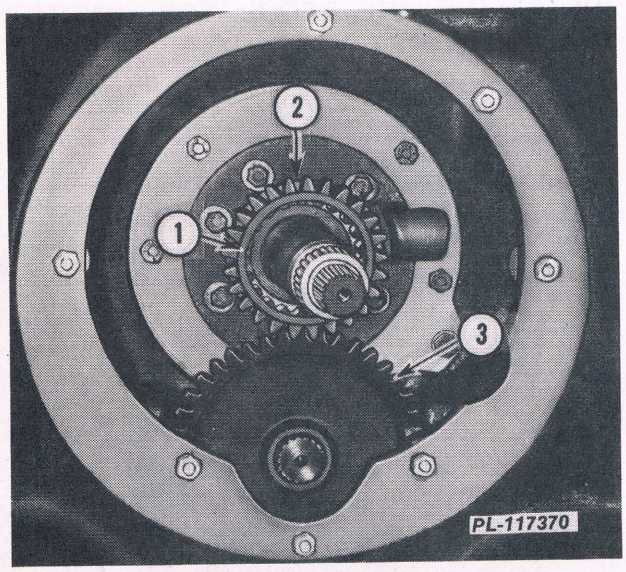

Fig. 61
Installing PTO Drive Gear

1. PTO Drive Gear
2. Spacer Washer
3. PTO Driven Gear

5. Install front cover assembly (1, Fig. 62) and secure in place using eight bolts.

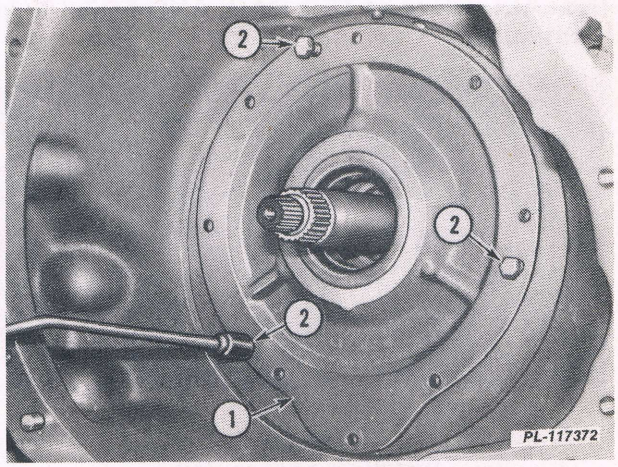

Fig. 62
Installing Front Cover Assembly

1. Front Cover Assembly
2. Jack Screws

INSTALLING SHIFTER RAIL AND FORKS

1. Install first gear fork (3, Fig. 64) into the transmission housing. Position fork on synchronizer plate, slide shift rail through the rear of the transmission housing and first gear fork as shown in Fig. 63. Install the second and third gear fork in the same manner. Slide the shifter rail in place and install shift hub.

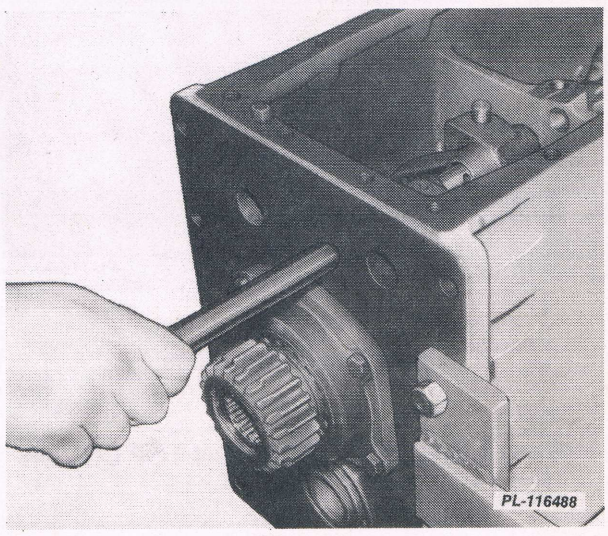

Fig. 63
Installing Shift Rail

2. Install roll pins (2, Fig. 64) to first gear fork (3) and shift hub.

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INSTALLING SHIFTER RAIL AND FORKS (Continued)

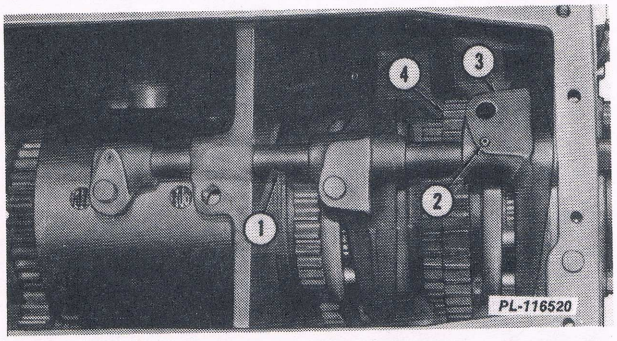

Fig. 64
Installing Shifter Rail

1. Shifter Rail
2. Roll Pin
3. First Gear Fork
4. First Gear

3. Install cam rollers (1, Fig. 65) to shift forks.

NOTE: *The shift mechanism must move freely and not bind during the shift cycle.*

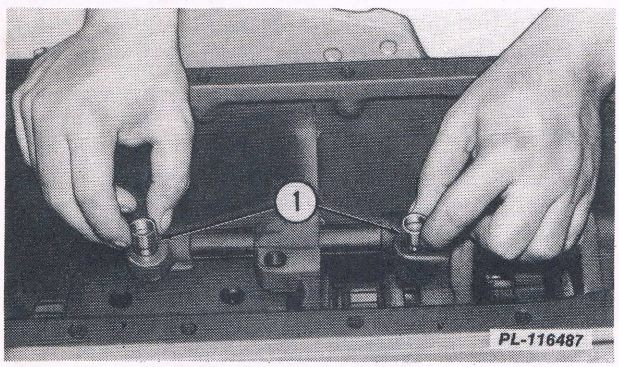

Fig. 65
Installing Cam Rollers

INSTALLING TRANSMISSION TOP COVER (Fig. 66)

1. Place shift cam (1) in same gear speed as the gear forks.
2. Install top cover (2) and gasket (3) on the transmission by moving the cam actuating arm until the top cover is seated in place. Secure the top cover by using sixteen bolts and washers.

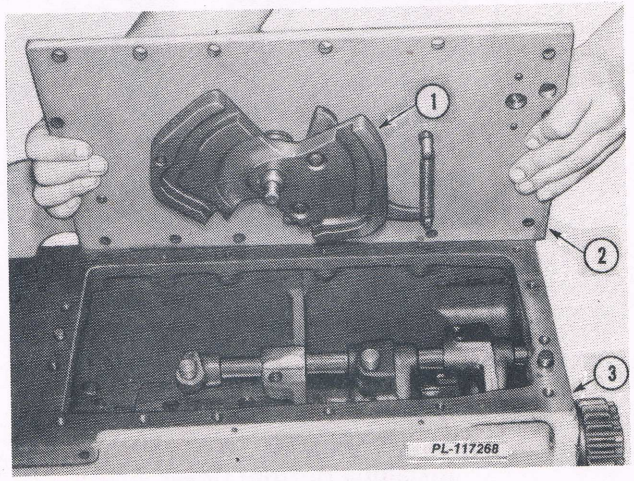

Fig. 66
Installing Transmission Top Cover

1. Shifter Cam
2. Top Cover
3. Gasket

INSTALLING THE REGULATOR JUNCTION VALVE (Fig. 67)

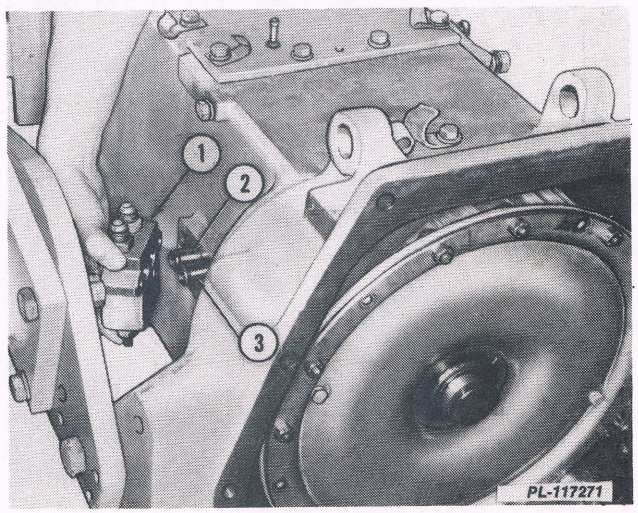

Fig. 67
Installing Regulator Junction Valve

1. Regulator Junction Valve
2. Lubrication Tube
3. Torque Converter Outlet Tube

Install the regulator junction valve (1) to the transmission housing, being careful not to damage "O" rings. Secure in place using two bolts.

INSTALLING THE DUMP AND MODULATION CONTROL VALVE (Fig. 68)

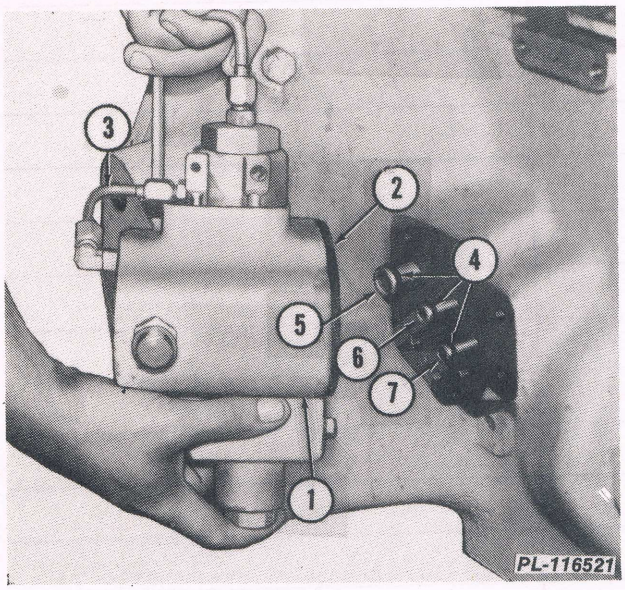

Fig. 68
Installing the Dump and Modulation Control Valve

1. Dump and Modulation Control Valve
2. Gasket
3. Forward Modulation Tube
4. "O" Rings
5. Converter Inlet Tube
6. Forward Clutch Tube
7. Reverse Clutch Tube

1. Install the dump and modulation control valve (1) and gasket (2) to the transmission housing, being careful not to damage "O" rings. Secure in place using four bolts.
2. If necessary install the forward modulation tube (3) to the valve.

INSTALLING TORQUE CONVERTER UNIT

Install the torque converter unit (1, Fig. 69) to the transmission input shaft.

NOTE: *The torque converter unit is only splined to the transmission input shaft. Care must be used not to drop the torque converter unit out of place when installing the transmission to the tractor. Refer to chassis service manual for procedures on installation of transmission.*

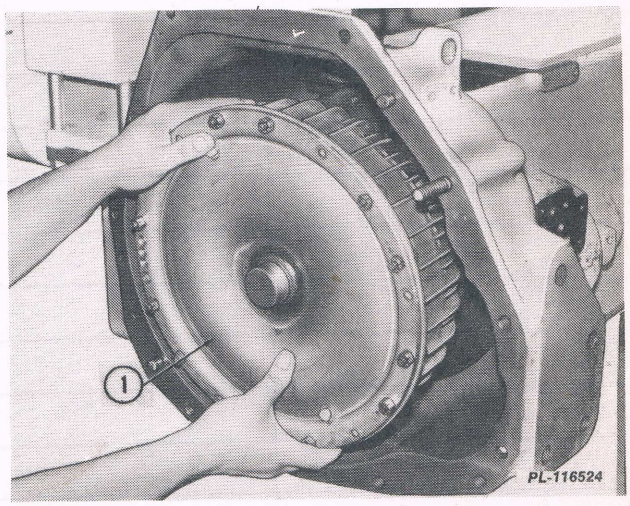

Fig. 69
Installing Torque Converter Unit

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

TORQUE CONVERTER UNIT

CONTENTS

TORQUE CONVERTER UNIT

GENERAL

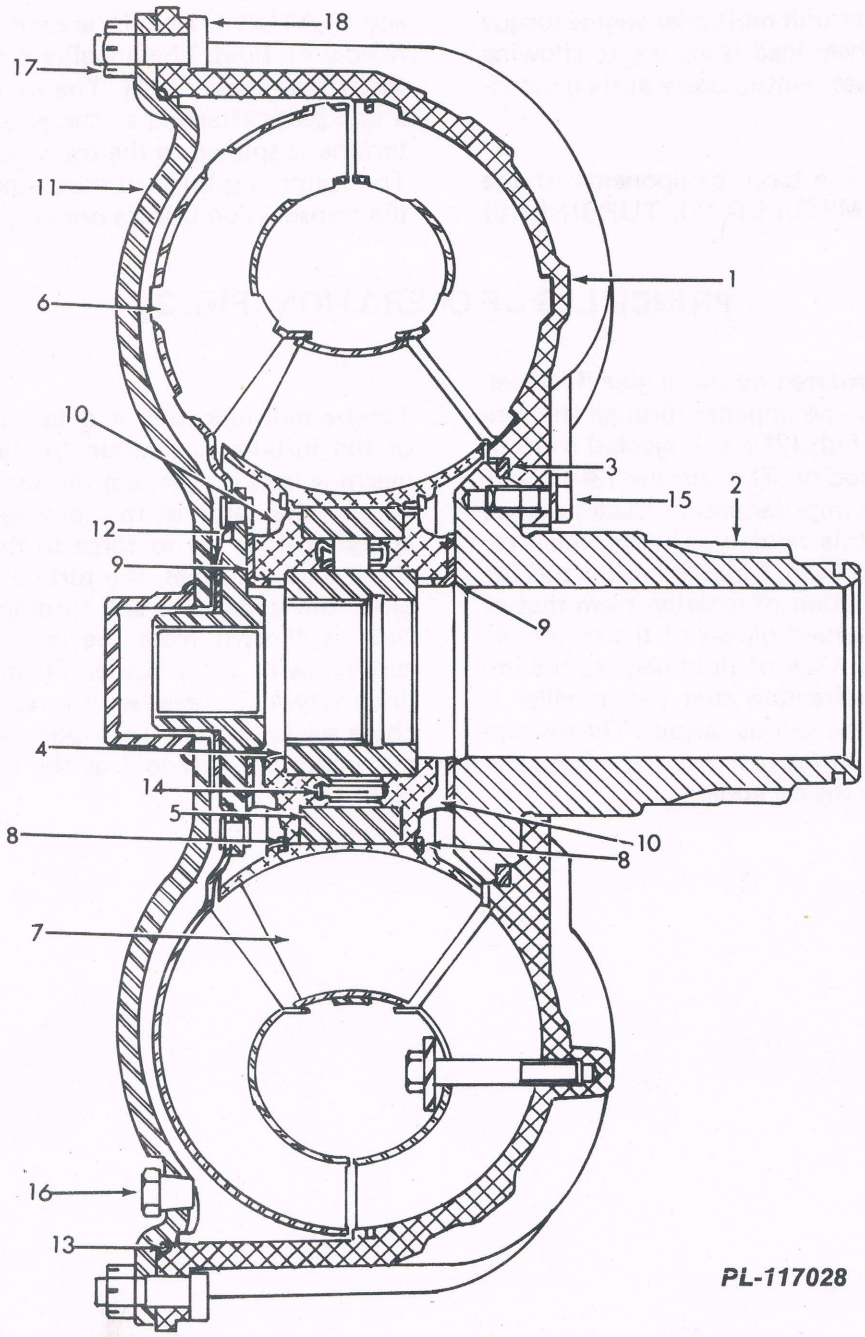

Fig. 1
Cross Section of Torque Converter

1. Impeller
2. Impeller Hub
3. Gasket
4. Inner Race
5. Outer Race
6. Turbine
7. Stator
8. Snap Ring
9. Stator Side Thrust Washer
10. Stator Thrust Washer
11. Front Cover
12. Thrust Washer
13. "O" Ring
14. One-way Clutch Bearing
15. Bolt and Washer
16. Plug
17. Castle Nut
18. Front Cover Bolt

TORQUE CONVERTER UNIT

GENERAL

The torque converter unit multiplies engine torque automatically as wheel load is increased, allowing the engine to operate continuously at its most efficient speed.

(Refer to Fig. 1). The basic components of the converter are the IMPELLER (1), TURBINE (6) and STATOR (7) which are enclosed in a housing filled with fluid. The impeller is bolted to the converter front cover.(11). The impeller is driven by a flex plate attached to the engine flywheel. The turbine is splined to the transmission clutch pack. The stator is splined to the stator support shaft in the transmission using a one-way clutch.

PRINCIPLES OF OPERATION (FIG. 2)

The impeller (1) is rotated by the engine flywheel. Fluid is supplied to the impeller through the center of the impeller hub (2) and is ejected from its blades at a high velocity. The turbine (3) is positioned opposite the impeller and its blades receive the full impact of this velocity. The turbine is rotated by this ejected fluid. Fluid leaves the turbine in the opposite direction of rotation from that of the impeller. The curved blades of the stator (4) re-direct part of the flow of fluid back to the impeller in the same direction that the impeller is moving to increase the torque output. The remaining fluid flows out through the center of the stator support shaft to the oil cooler.

Torque multiplication is determined by the speed of the turbine in relation to the impeller. When machine load is light, the turbine speed is approximately the same as the impeller speed, thereby applying little or no force to the blades. As machine load increases, the turbine speed decreases. Since the impeller is still turning at engine speed, fluid is thrown from the impeller and into the turbine with great force. Engine torque to the drive wheels increase with a resulting loss of machine speed. Torque multiplication increases to a maximum of 2.54 to 1 as the turbine slows to a stop.

TORQUE CONVERTER UNIT

PRINCIPLES OF OPERATION (FIG. 2)

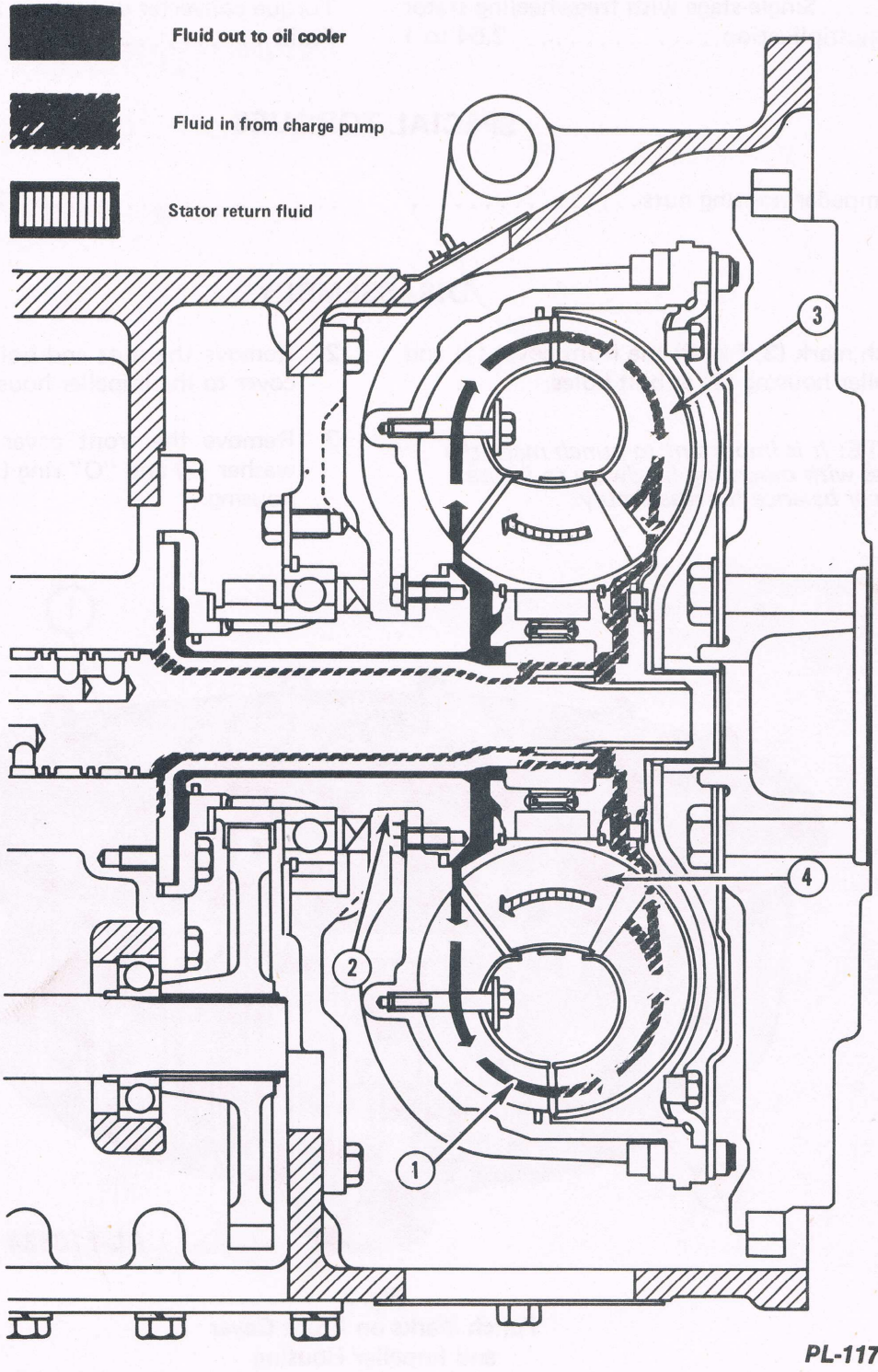

Fig. 2
Fluid Flow

1. Impeller
2. Impeller Hub
3. Turbine
4. Stator

TORQUE CONVERTER UNIT

SPECIFICATIONS

Type. . . . . .Single-stage with freewheeling stator
Torque multiplication . . . . . .2.54 to 1
Torque converter diameter. 298.5mm (11.75 in.)
Fluid . . . . . HY-TRAN®

SPECIAL TORQUES

Hub to impeller housing nuts . . . . . 29.8 N•m (22 ft-lbs.)

DISASSEMBLY

1. Punch mark (3, Fig. 3) the front cover (1) and impeller housing (2) at bolt holes.

   NOTE: *It is important to punch mark the holes with mounting hardware to insure proper balance for reassembly.*

2. Remove the nuts and bolts securing the front cover to the impeller housing.

3. Remove the front cover (1, Fig. 4), thrust washer (2) and "O" ring (3) from the impeller housing.

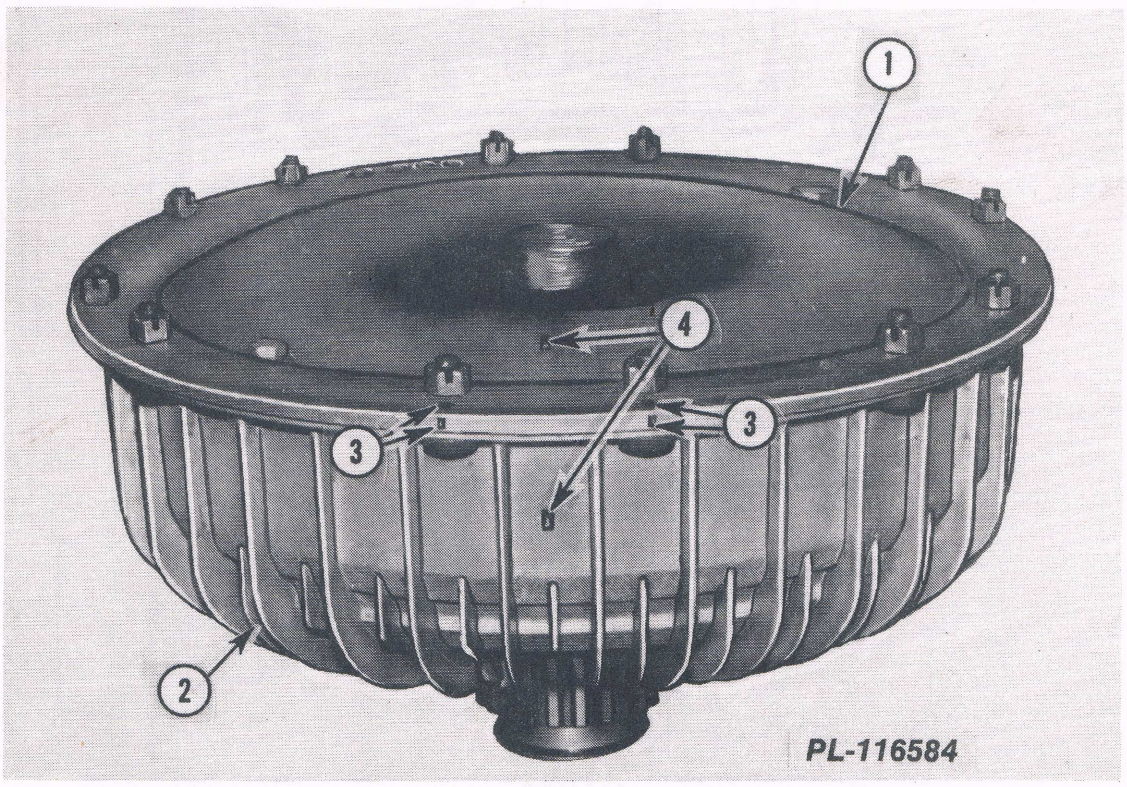

Fig. 3
Punch Marks on Front Cover and Impeller Housing

1. Front Cover
2. Impeller Housing
3. Punch Marks
4. Front Cover Mark and Impeller Housing Identification Mark

DISASSEMBLY

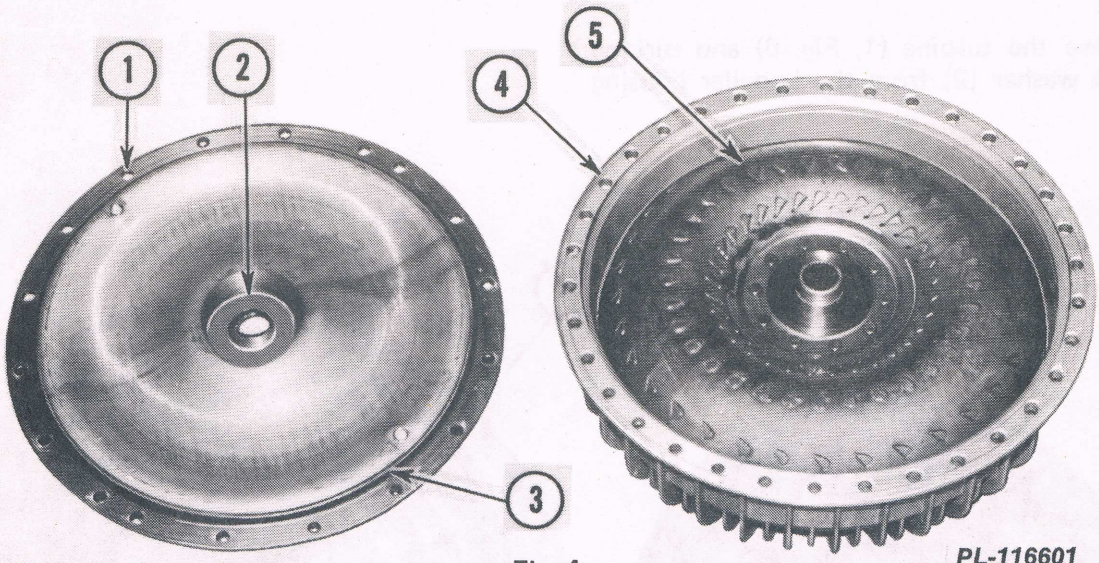

Fig. 4
Front Cover Removal

1. Front Cover
2. Thrust Washer
3. "O" Ring
4. Impeller Housing
5. Turbine

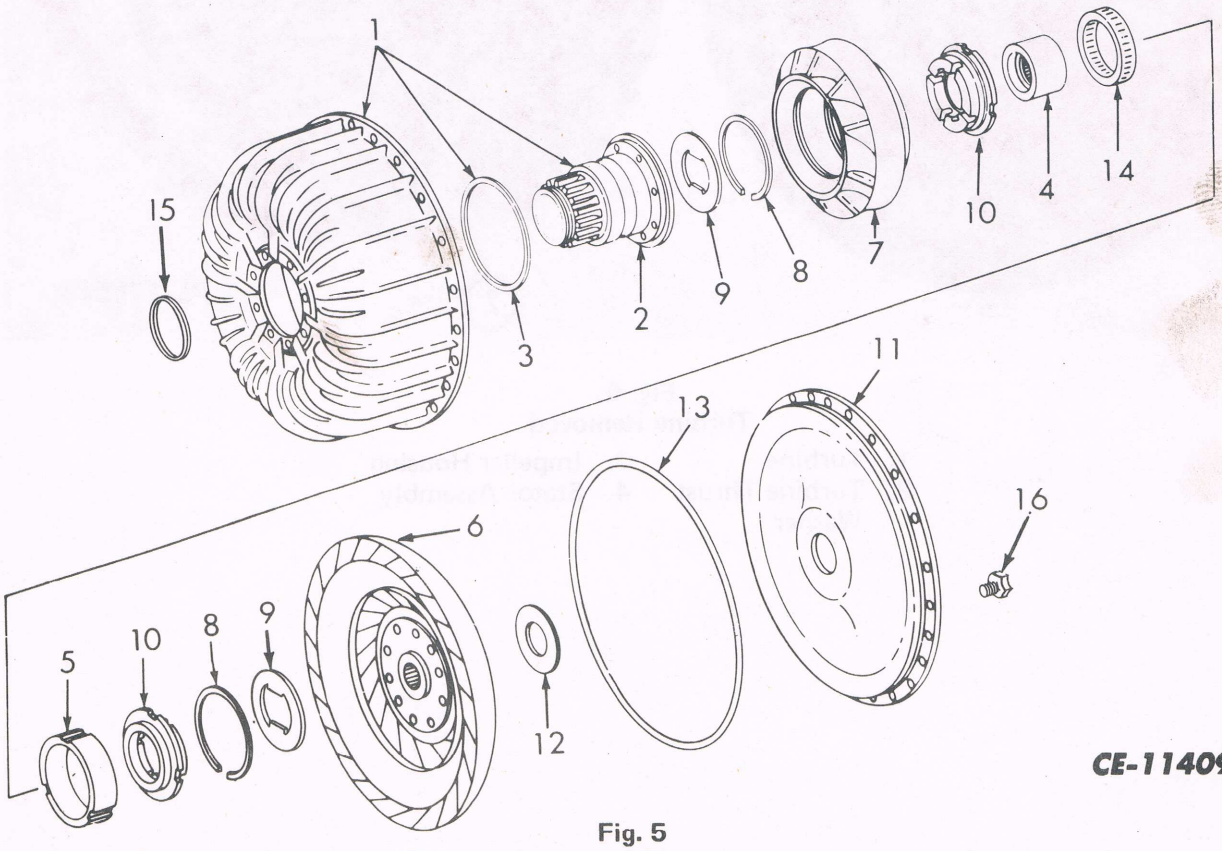

Fig. 5
Exploded View of Torque Converter

1. Impeller Assembly
2. Impeller Hub
3. Gasket
4. Inner Race
5. Outer Race
6. Turbine
7. Stator
8. Snap Ring
9. Thrust Washer
10. Stator Thrust Washer
11. Front Cover
12. Turbine Thrust Washer
13. "O" Ring
14. One-way Clutch
15. Seal Ring
16. Plug

TORQUE CONVERTER UNIT

DISASSEMBLY

4. Remove the turbine (1, Fig. 6) and turbine thrust washer (2) from the impeller housing (3).

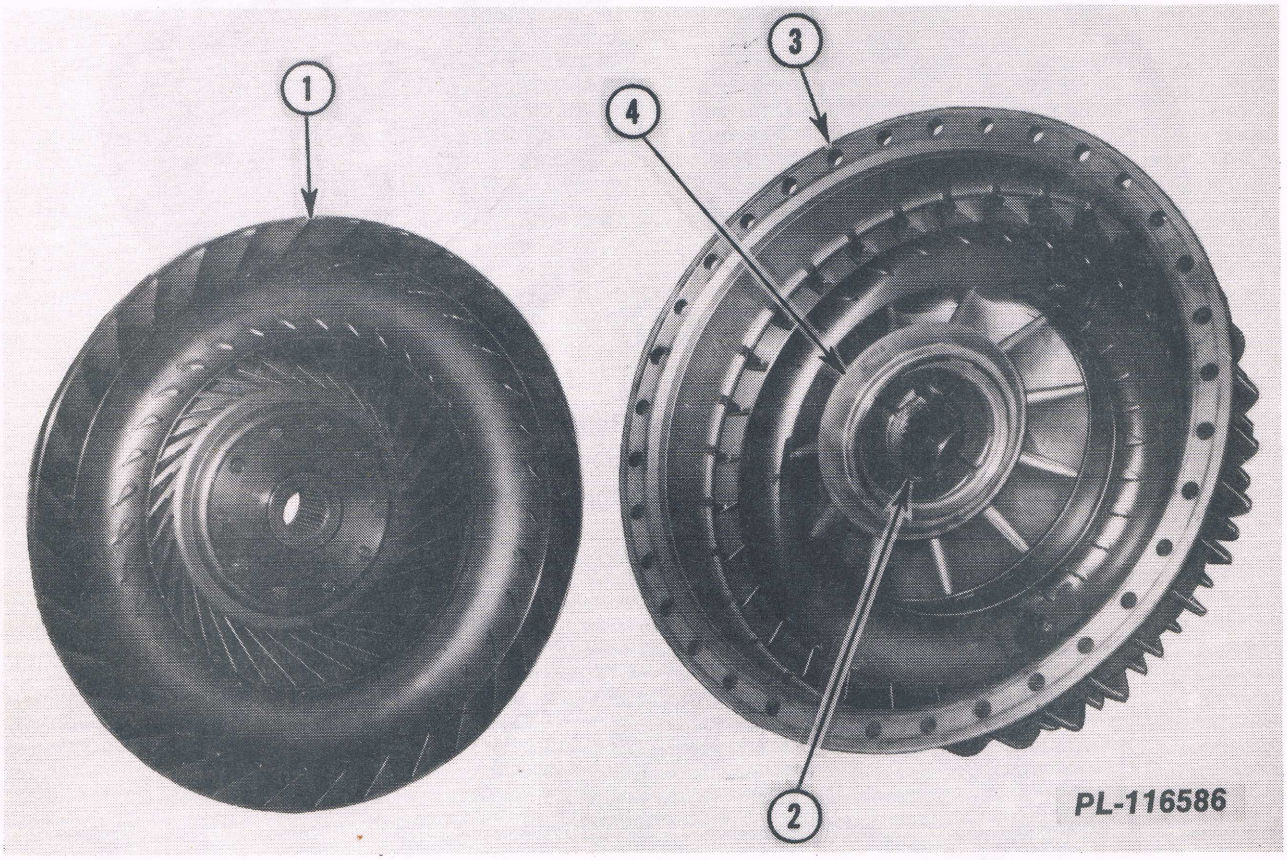

Fig. 6
Turbine Removed

1. Turbine
2. Turbine Thrust Washer
3. Impeller Housing
4. Stator Assembly

DISASSEMBLY

5. Remove the stator assembly (1, Fig. 7) and impeller thrust washer (2) from the impeller housing (3).

6. Remove the bolts securing impeller hub (1, Fig. 8) and hub seal ring (2) to impeller housing (3). Remove the seal ring (4) from impeller hub.

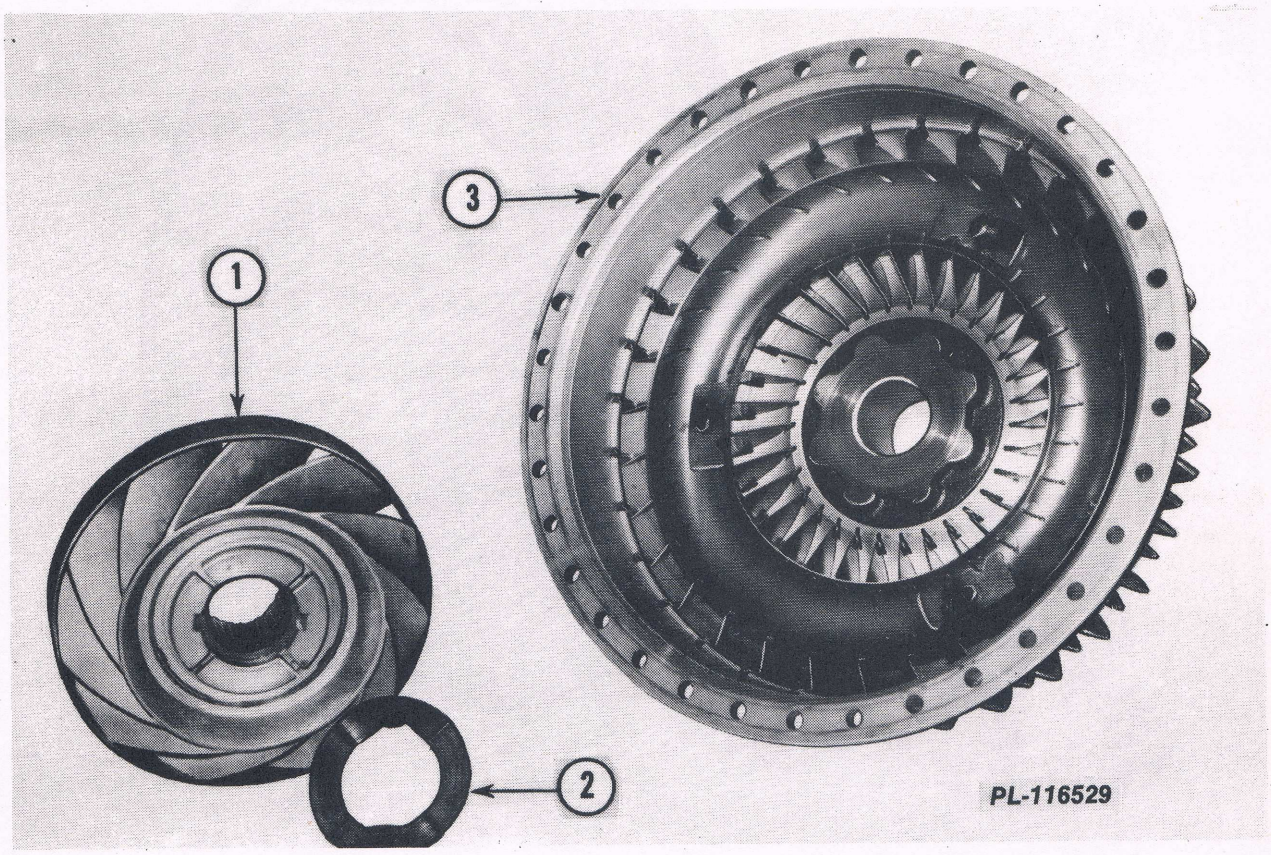

Fig. 7
Stator Assembly Removed

2. Impeller Thrust Washer
3. Impeller Housing
1. Stator Assembly

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TORQUE CONVERTER UNIT

DISASSEMBLY

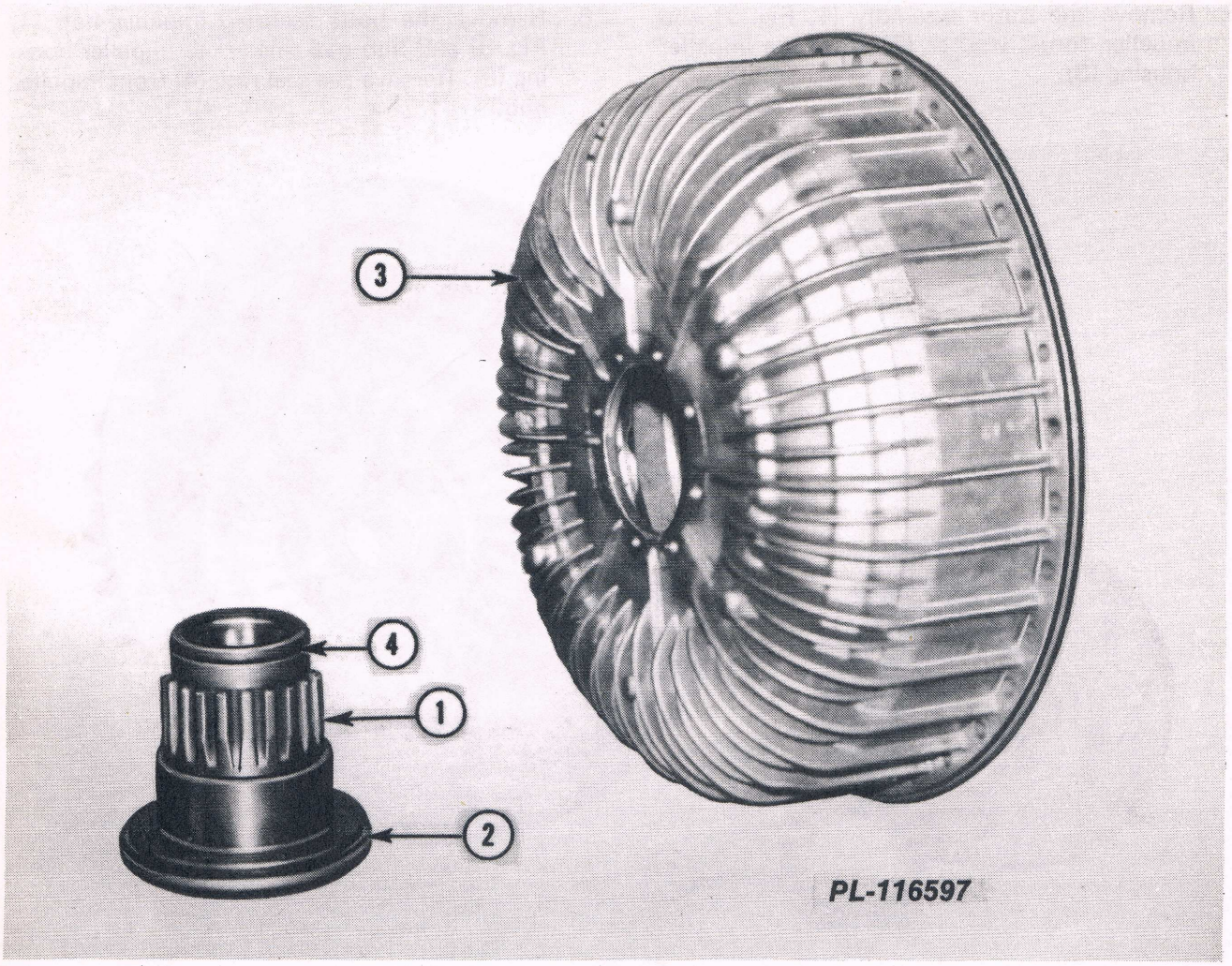

Fig. 8
Impeller Removed from Impeller Housing

1. Impeller Hub
2. Hub Seal Ring
3. Impeller Housing
4. Seal Ring

7. Place the stator (1, Fig. 9) with side marked "FRONT" (2) up.

8. Remove snap ring (3, Fig. 9) and turbine side thrust washer (4) from the stator.

DISASSEMBLY

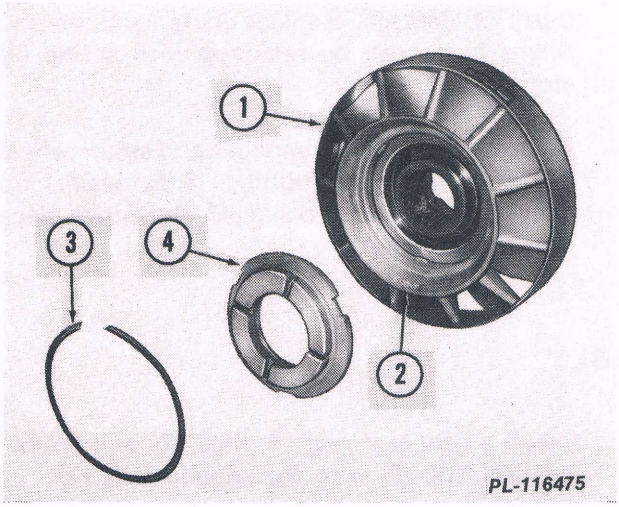

Fig. 9
Turbine Side Disassembly of Stator

1. Stator Assembly
2. "FRONT" Side Up
3. Snap Ring
4. Turbine Side Thrust Washer

7. Remove the inner race (1, Fig. 10), one-way clutch (2) and the outer race (3) from the stator assembly.

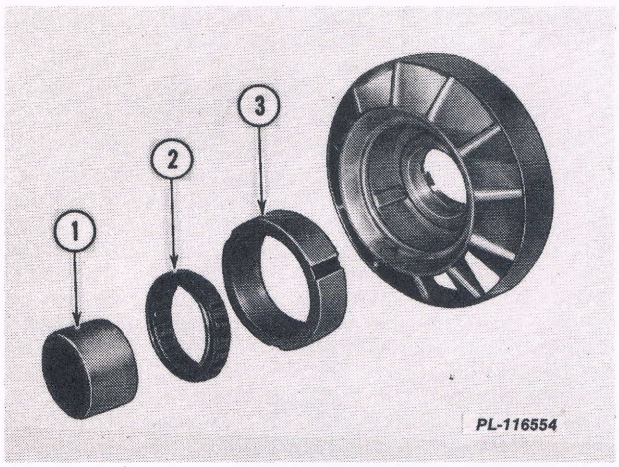

Fig. 10
One-Way Clutch and Races Removed

1. Inner Race
2. One-way Clutch
3. Outer Race

8. Turn the stator over and remove remaining snap ring (1, Fig. 11) and impeller side thrust washer (2).

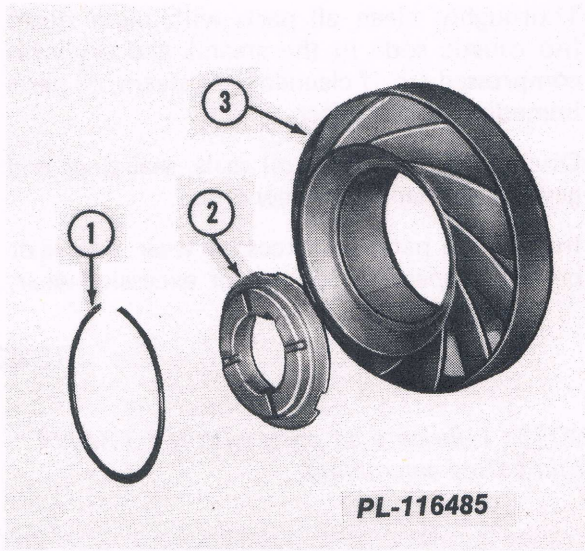

Fig. 11
Impeller Side Disassembly of Stator

1. Snap Ring
2. Impeller Side Thrust Washer
3. Stator

TORQUE CONVERTER UNIT

INSPECTION AND REPAIR

1. Thoroughly clean all parts with plain steam (no caustic soda in the steam) and dry with compressed air. If cleaned with steam, oil parts immediately thereafter.
2. Discard all "O" rings, oil seals, seal rings and gaskets. Replace with new ones.
3. Inspect the parts for excessive wear, cracks or breaks. Inspect all splines for excessive wear, burrs or damage. Replace parts as necessary. Slight burrs can be removed with a fine oil stone.
4. Inspect the turbine, impeller and stator wheel blades for signs of rubbing. If the blades are excessively worn or damaged, the entire piece must be replaced.

REASSEMBLY

NOTE: *Lubricate all parts with HY-TRAN® fluid before assembling.*

1. Install a new seal ring (4, Fig. 12) and a new hub seal ring (2) onto the impeller hub (1).

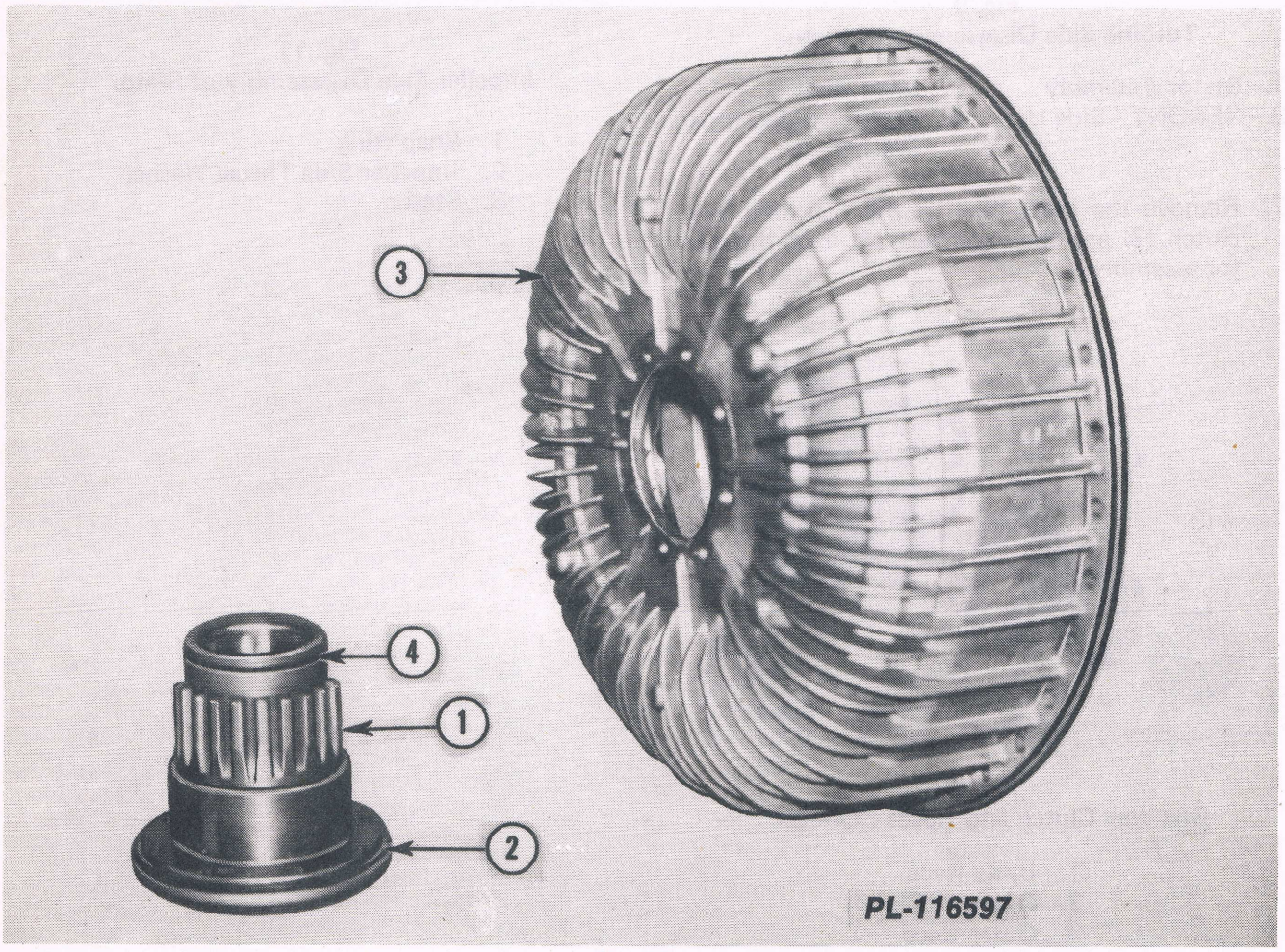

Fig. 12
Seal Rings Installed on Impeller Hub

1. Impeller Hub
2. Hub Seal Ring
3. Impeller Housing
4. Seal Ring

2. Install the impeller hub to impeller housing. Refer to Fig. 13. Torque the mounting bolts to 10-12 N•m (8-10 ft-lbs.).

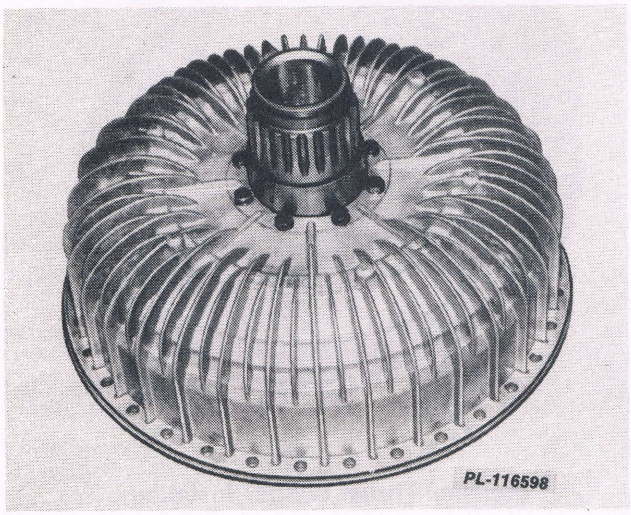

Fig. 13
Impeller Hub Mounted to Impeller Housing

3. Install snap ring (1, Fig. 14) in the groove on impeller side of the stator (2).

NOTE: *To determine the different sides of the stator; the impeller side has the thin fins, the turbine side has the thick blades and the word "FRONT" marked on the collar.*

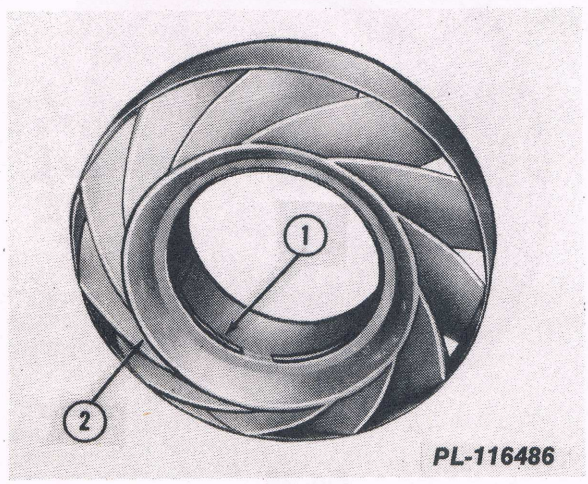

Fig. 14
Snap Ring Installed in Stator

1. Snap Ring 2. Impeller Side of Stator

4. Turn the stator assembly over so the side with "FRONT" is facing up (turbine side of stator) (1, Fig. 15).

5. Install the impeller side thrust washer (2), using the three aligning marks (3) in the stator. Be sure the washer is seated all the way down inside the bore of stator and against the snap ring.

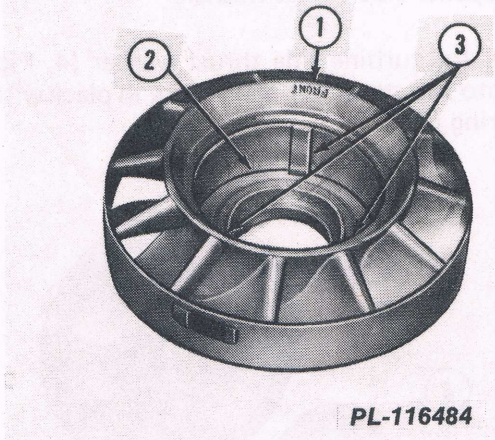

Fig. 15
Impeller Side Thrust Washer Installed in Stator

1. "FRONT" Side Up (Turbine Side of Stator)
2. Impeller Side Thrust Washer
3. Three Aligning Marks

6. Install the outer race (1, Fig. 16) in the stator assembly (2) until it is flush against the impeller side of the thrust washer.

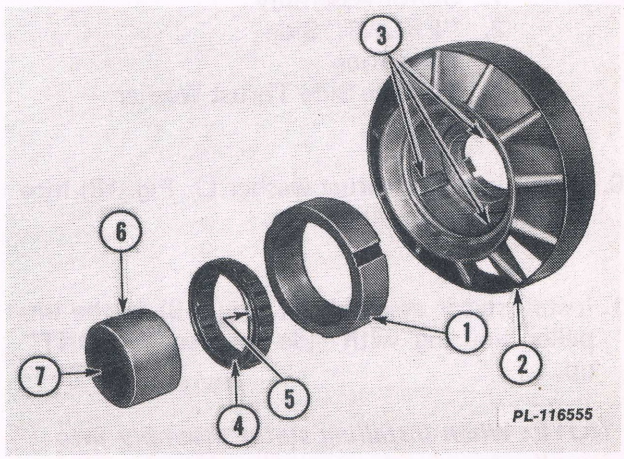

Fig. 16
Installation of Stator Assembly

1. Outer Race
2. Stator
3. Three Aligning Marks
4. One-way Clutch Sprag
5. Cut Flange
6. Inner Race
7. Splined End

TORQUE CONVERTER UNIT

REASSEMBLY

7. Install the one-way clutch sprag (4) with the "lip" side (side with cut flange (5)) up.

8. Install the inner race (6), with the splined end (7) up, into the stator until it is flush against the impeller side thrust washer.

9. Install the turbine side thrust washer (4, Fig. 17) into the stator (1) and secure in place with snap ring (3).

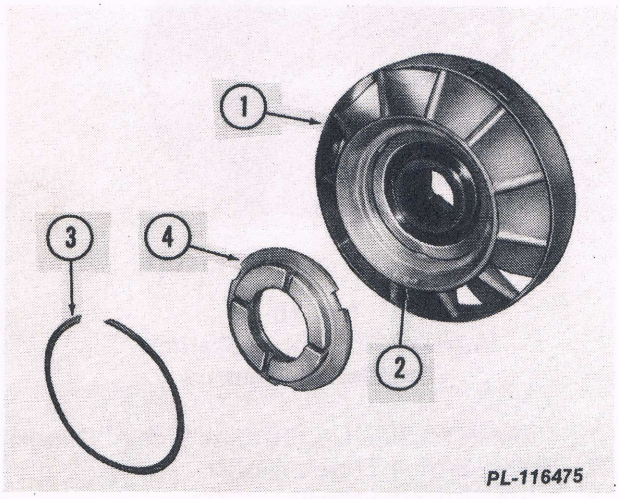

Fig. 17
Final Stator Assembly

1. Stator Assembly
2. "FRONT" Side
3. Snap Ring
4. Turbine Side Thrust Washer

10. Install impeller thrust washer (1, Fig. 18) into the impeller housing.

11. Install stator assembly (1, Fig. 19) in the impeller housing with side marked "FRONT" up.

NOTE: *When installing stator assembly into impeller housing be sure tabs of the impeller thrust washer align with grooves in the impeller side thrust washer.*

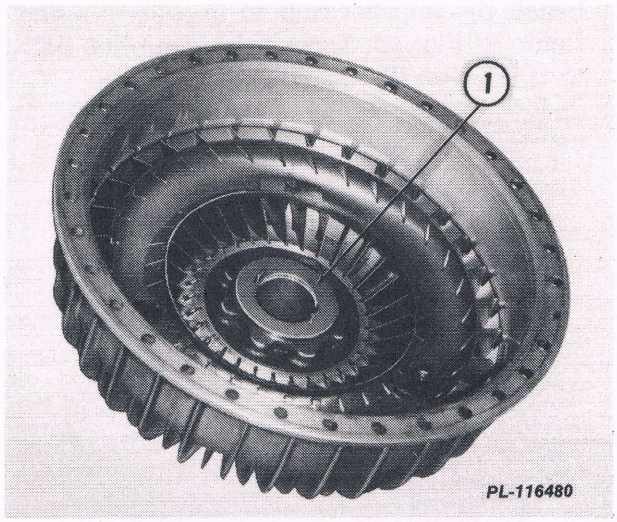

Fig. 18
Impeller Thrust Washer Installed

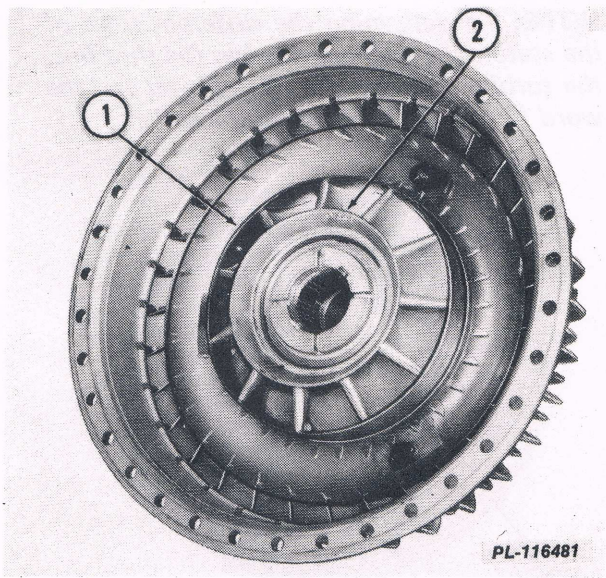

Fig. 19
Stator Assembly Installed in Impeller Housing

1. Stator Assembly 2. Side Marked "FRONT"

REASSEMBLY

12. Install turbine thrust washer (1, Fig. 20) onto the stator assembly (2).

13. Install the turbine (3, Fig. 20) into the impeller housing.

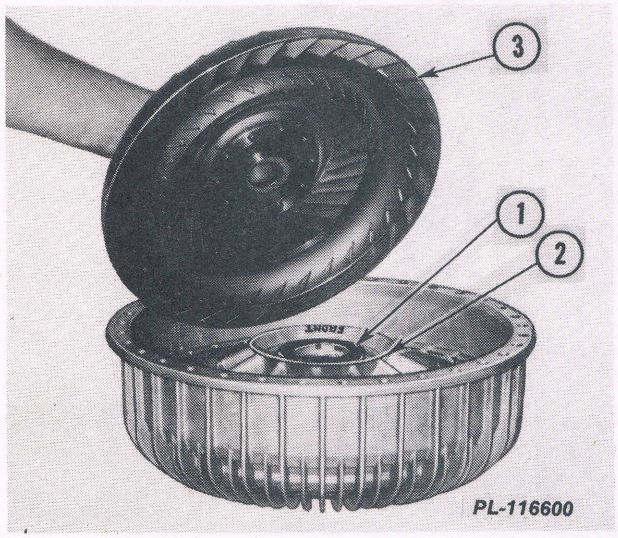

Fig. 20
Installing Turbine Assembly

1. Turbine Thrust Washer
2. Stator Assembly
3. Turbine

14. Install the thrust washer (1, Fig. 21) onto turbine shaft.

15. Install the front cover (2, Fig. 21) and "O" ring (3) onto the impeller housing.

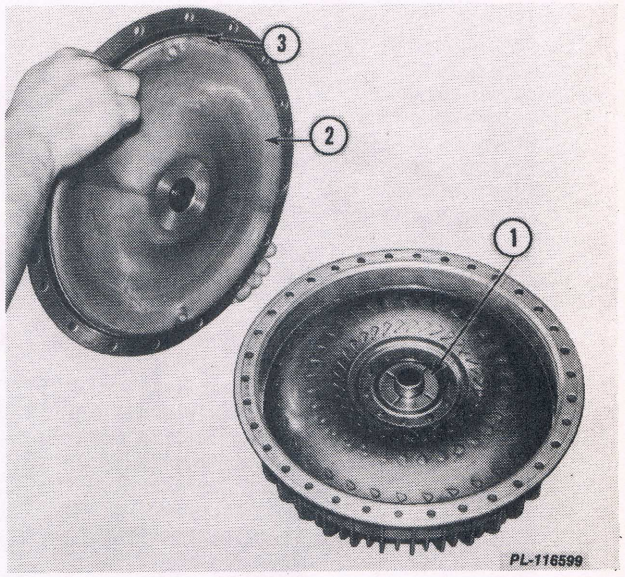

Fig. 21
Installing the Front Cover

1. Thrust Washer
2. Front Cover
3. "O" Ring

16. Install the 18 bolts and nuts in the holes that were punch marked (3, Fig. 22). Torque the nuts to 29.8 N•m (22 ft-lbs.).

NOTE: *If either the front cover or impeller housing were replaced, align the four digit identification on the impeller housing to the front cover mark to assure proper balance.*

(continued on next page)

TORQUE CONVERTER UNIT

REASSEMBLY

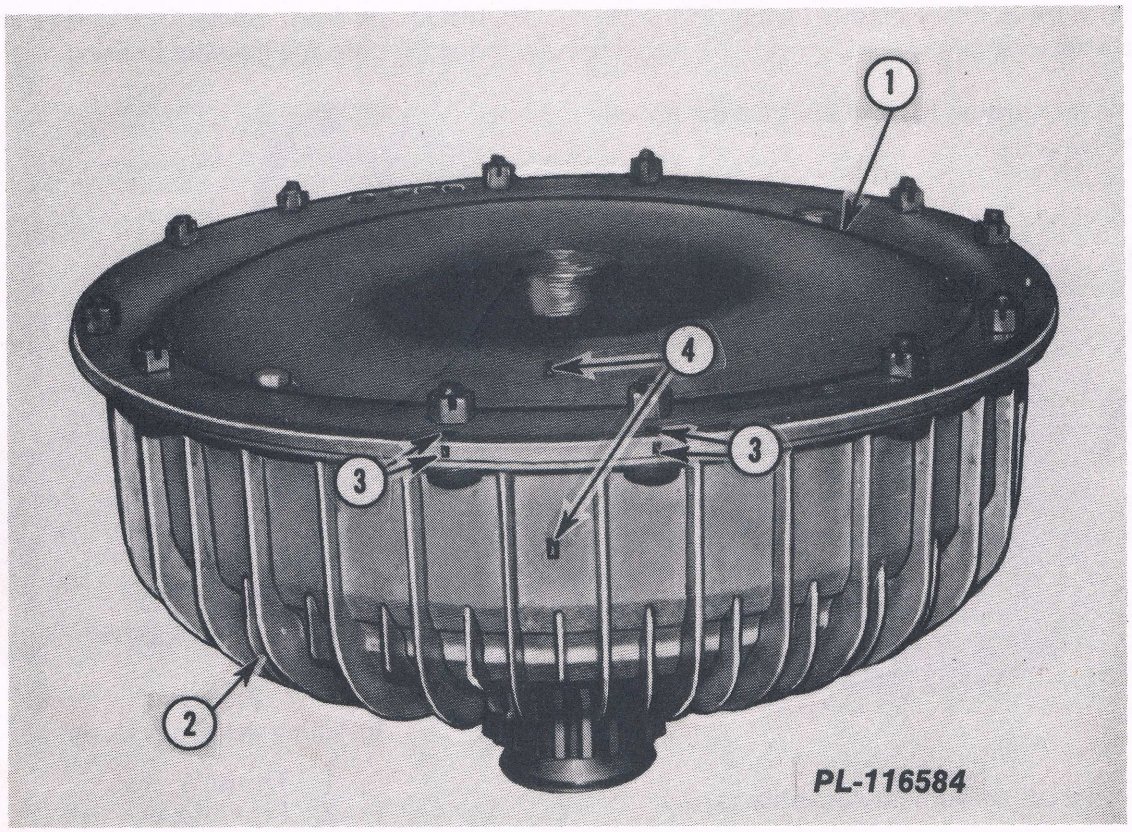

Fig. 22
Punch Marks on Front Cover and Impeller Housing

1. Front Cover
2. Impeller Housing
3. Punch Marks
4. Front Cover Mark and Impeller Housing Identification Mark

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

CLUTCH PACK

CONTENTS

CLUTCH PACK

GENERAL

The forward-reverse clutch pack consists of a shaft and drum assembly with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" or sealed by the use of teflon sealing rings and "O" rings. Connected to the shaft is a return spring which rests up against the piston. Wear plates with internal splines and drive plates with external splines are alternated until the required total is achieved. The drive plates are splined to the shaft and drum assembly. An output gear is splined to the wear plates.

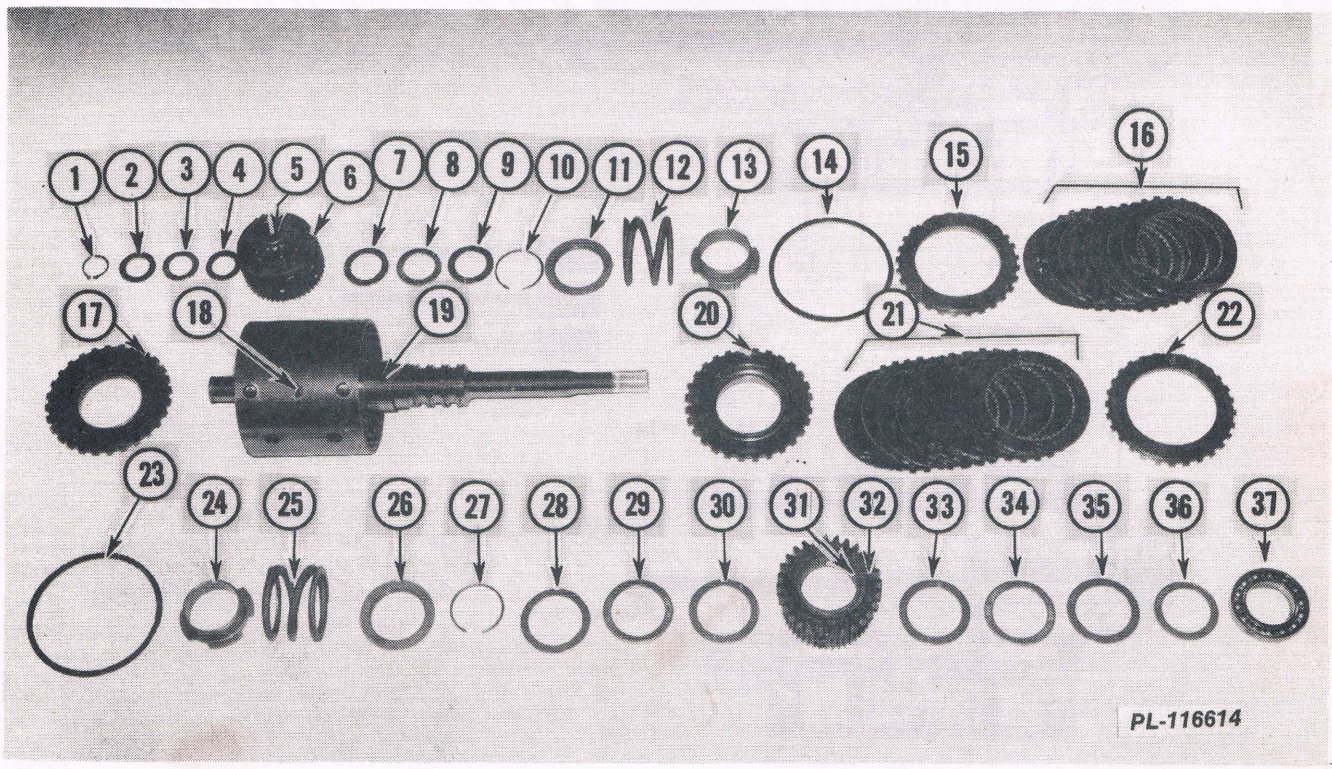

Fig. 1
Clutch Pack

1. Snap Ring
2. Bearing Race
3. Needle Thrust Bearing
4. Bearing Race
5. Needle Bearing
6. Forward Gear
7. Bearing Race
8. Needle Thrust Bearing
9. Bearing Race
10. Retainer Ring
11. Spring Retainer
12. Spring
13. Lube Sleeve
14. Spiral Snap Ring
15. Forward Support Plate
16. Forward Drive Plates and Friction Discs
17. Forward Piston
18. Internal Snap Ring
19. Clutch Shaft Assembly (Consisting of input shaft, clutch hub and coupling)
20. Reverse Piston
21. Reverse Drive Plates and Friction Discs
22. Reverse Support Plate
23. Spiral Snap Ring
24. Lube Sleeve
25. Spring
26. Spring Retainer
27. Retainer Ring
28. Bearing Race
29. Needle Thrust Bearing
30. Bearing Race
31. Needle Bearing
32. Reverse Gear
33. Bearing Race
34. Needle Thrust Bearing
35. Bearing Race
36. Backup Washer
37. Oil Distributing Housing Bearing

CLUTCH PACK

PRINCIPLE OF OPERATION

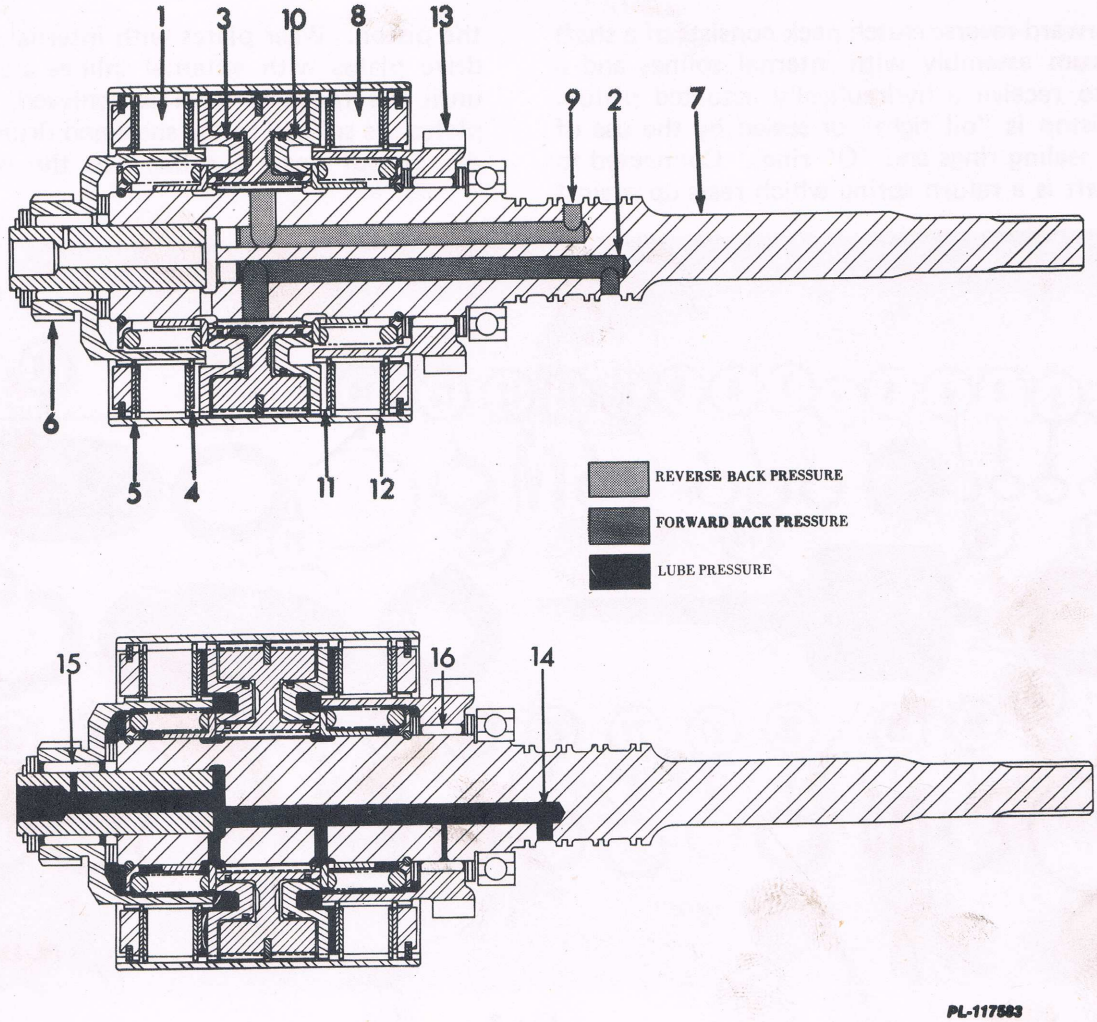

Fig. 2
Forward/Reverse Clutch Pack

1. Forward Clutch Pack
2. Forward Oil Passage
3. Forward Piston
4. Forward Wear Plates
5. Forward Drive Plates
6. Forward Drive Gear
7. Input Shaft
8. Reverse Clutch Pack
9. Reverse Oil Passage
10. Reverse Piston
11. Reverse Wear Plate
12. Reverse Drive Plates
13. Reverse Drive Gear
14. Lube Passage
15. Forward Drive Gear Bearing
16. Reverse Drive Gear Bearing

Refer to (Fig. 2). Oil enters the designated clutch pack (1 or 8) through the oil passage (2 or 9) engaging the piston (3 or 10). The applied piston couples the wear plates (4 or 11) with the drive plates (5 or 12) causing the drive gear (6 or 13) to rotate with the input shaft (7).

Oil flowing through passage (14) lubricates the drive gear bearing (15 or 16) and aids in cooling the clutch packs.

CLUTCH PACK

SPECIFICATIONS

Clutch pack lockup pressure

Forward Pack 1206.5-1482.4 kPa (175-215 psi)
Reverse Pack 1206.5-1482.4 kPa (175-215 psi)

Lube pressure ..... 124.1-248.2 kPa (18-36 psi)

Return Spring

Free length ..... 56.8mm (2.2 in.)
Test length ..... 36.3mm (1.4 in.)
Test load ..... 154.3 kg (340 lbs.)
Number of coils 3.2

SPECIAL TOOLS

NOTE: *Before disassembling the clutch pack it is recommended that the following tools be fabricated to make disassembly and reassembly safer, easier and faster.*

CLUTCH SPRING COMPRESSOR TOOL

The spring can be removed safely and easily by modifying spring compressor tool number PLT-708-5 as shown in (Fig. 3).

NOTE: *Step numbers correspond with the numbers shown in (Fig. 3).*

1. PLT-708-5 clutch pack spring compressor tool.
2. Remove 63.5mm (2½ in.) from center of tool.
3. Grind the four outside edges 25.4mm (1 in.) down from top of tool.
4. Install a 177.8mm (7 in.) x 89mm (3½ in.)ID x 101.6mm (4 in.) OD pipe over ground edges and weld three edges on both sides.
5. Install 101.6mm (4 in.) x 25.4mm (1 in.) x 8mm (5/16 in.) spacer bar on top of pipe and weld in two places on both sides.

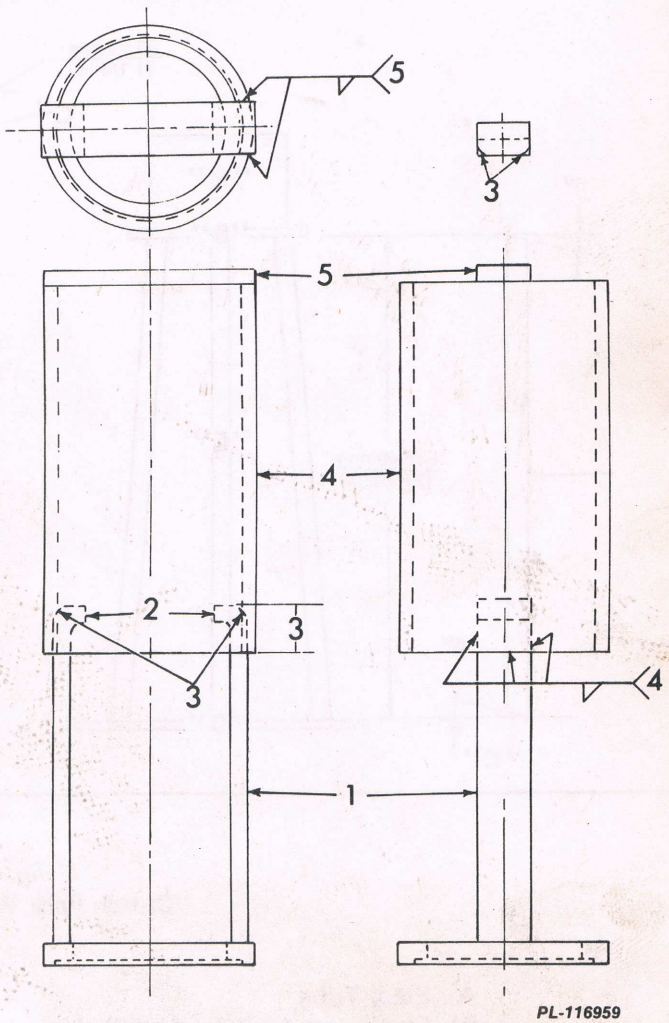

Fig. 3
Clutch Pack Spring Compressor Tool

CLUTCH PACK

SPECIAL TOOLS

CLUTCH PACK WORK STAND

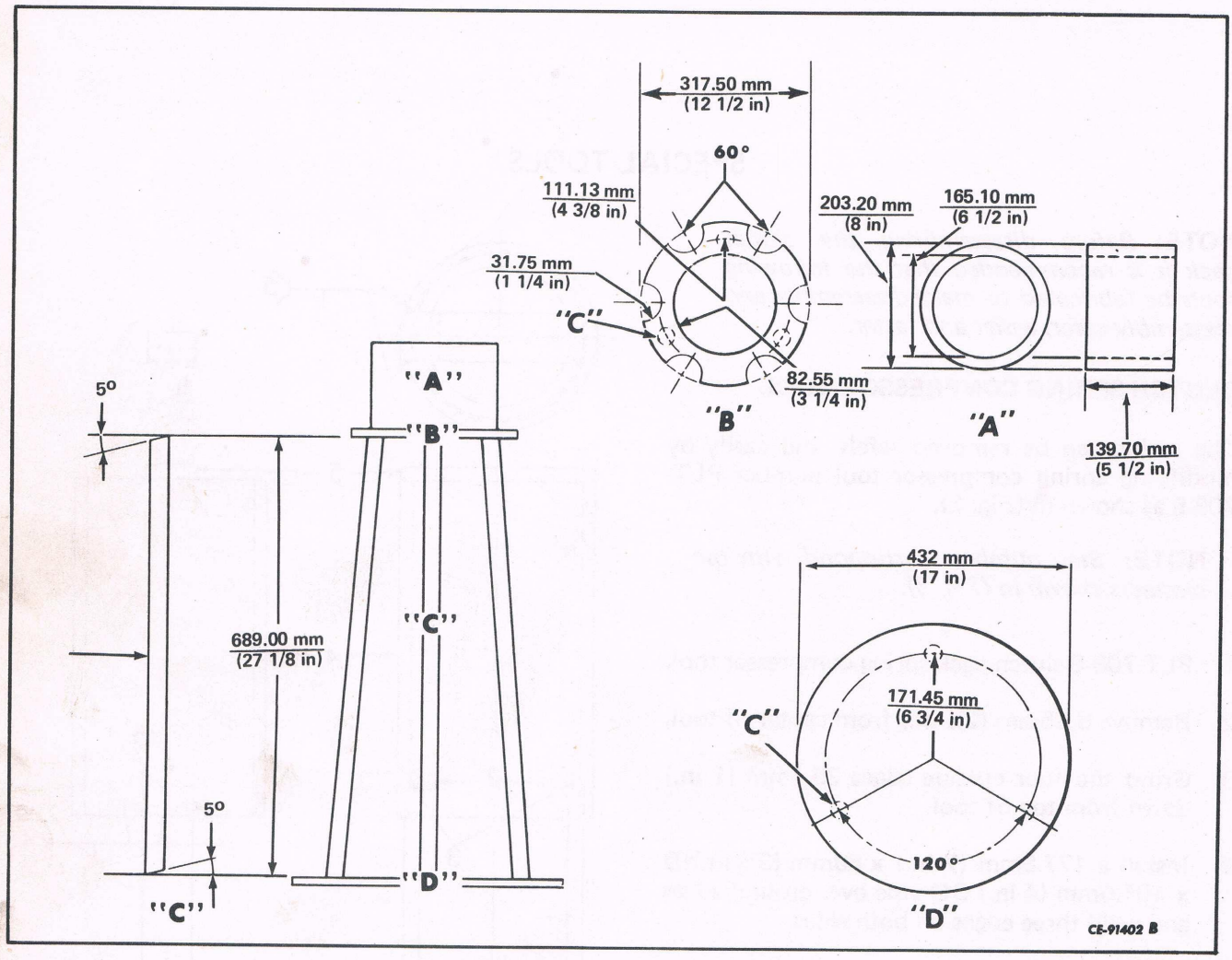

Fig. 4
Clutch Pack Work Stand

A) Steel Tube
B) Steel Plate 12.7mm (1/2") thick
C) 3 Steel Tubes 9.53mm x 28.58mm x 688.98mm (3/8" x 1-1/2" x 27-1/8")
D) Steel Plate 12.7mm (1/2") thick

CLUTCH PACK WORK STAND ADAPTING PLATE

NOTE: *Step numbers correspond with numbers shown in (Fig. 5).*

1. 202.3mm (8 in.) x 202.3mm (8 in.) x 6.35mm (1/4 in.) stock.
2. Scribe a 203.2mm (8 in.) circle from center of plate.
3. Remove a 111.1mm (4-3/8 in.) diameter hole from center of plate.
4. Weld four 125mm (1 in.) x 6.35mm (1/4 in.) x 6.35mm (1/4 in.) stock on the outside diameter of the 203.2mm (8 in.) scribed circle as shown.

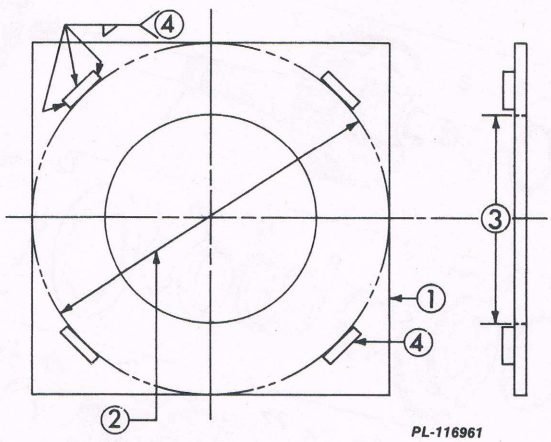

Fig. 5
Work Stand Adapting Plate

CLUTCH PACK

DISASSEMBLY

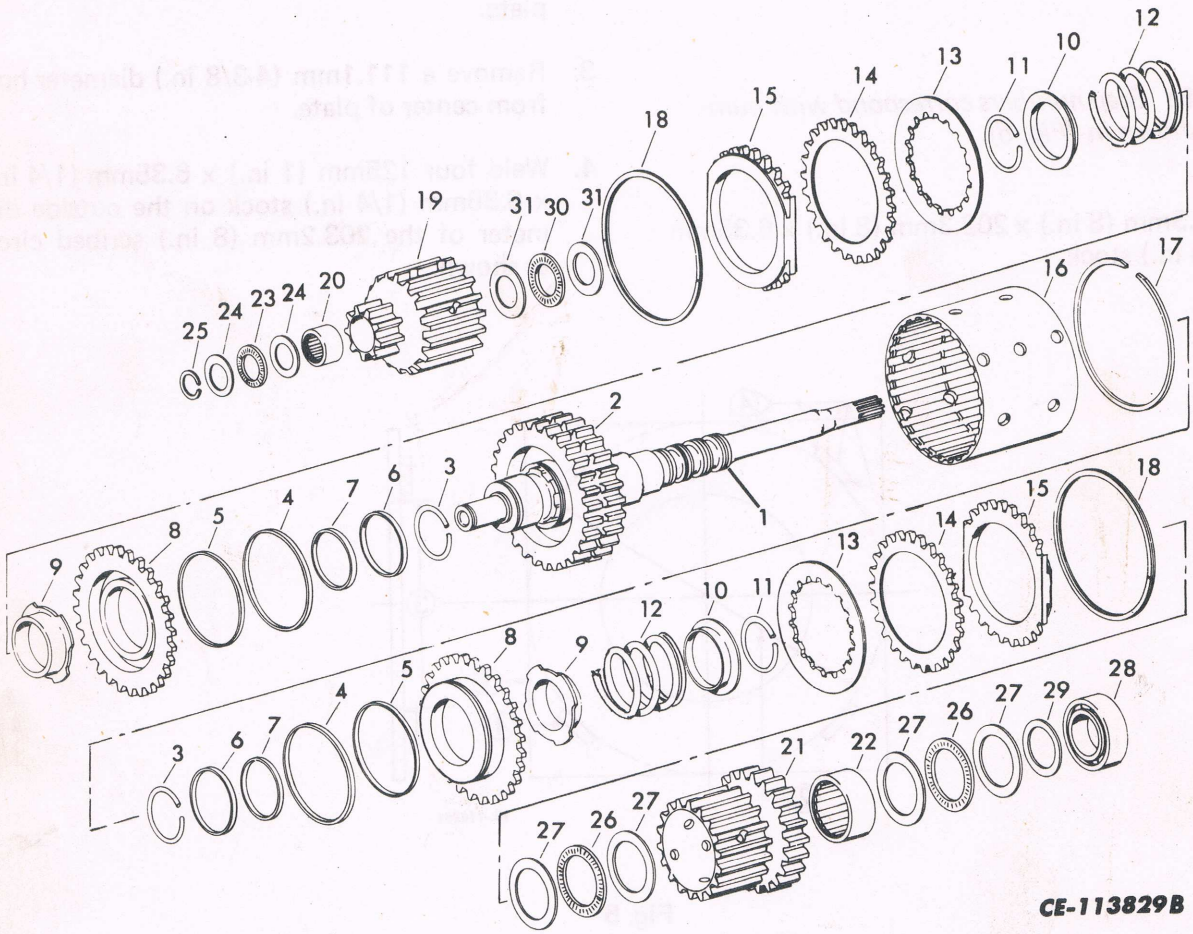

Fig. 6
Exploded View of Clutch Pack

1. Input Shaft
2. Clutch Hub
3. Retaining Ring
4. Piston Teflon Seal
5. Piston "O" Ring
6. Clutch Pack Teflon Seal
7. Clutch Pack "O" Ring
8. Piston
9. Lube Sleeve
10. Spring Retainer
11. Retainer Ring
12. Spring
13. Friction Disc
14. Drive Plate
15. Support Plate
16. Coupling
17. Internal Snap Ring
18. Spiral Retainer Ring
19. Forward Drive Gear
20. Needle Bearing
21. Reverse Drive Gear
22. Needle Bearing
23. Needle Thrust Bearing
24. Bearing Races
25. Snap Ring
26. Needle Thrust Bearing
27. Bearing Race
28. Oil Distributing Housing Bearing
29. Backup Washer
30. Needle Thrust Bearing
31. Bearing Race

CLUTCH PACK

DISASSEMBLY

NOTE: *The following disassembly procedure is for the forward and/or reverse clutch pack. Any differences in disassembly between either the forward pack or reverse pack are noted.*

1. Attach adapter plate (Fig. 5) to a suitable work stand (Fig. 4).

2. Place clutch pack assembly on the work stand. Refer to (Fig. 7).

3. FORWARD PACK: Remove snap ring (1, Fig. 8), bearing races (2) and needle thrust bearing (3).

3. REVERSE PACK: Using two pry bars spaced equally apart under reverse drive gear (1, Fig. 9) carefully pry gear to remove oil distributing housing bearing (2).

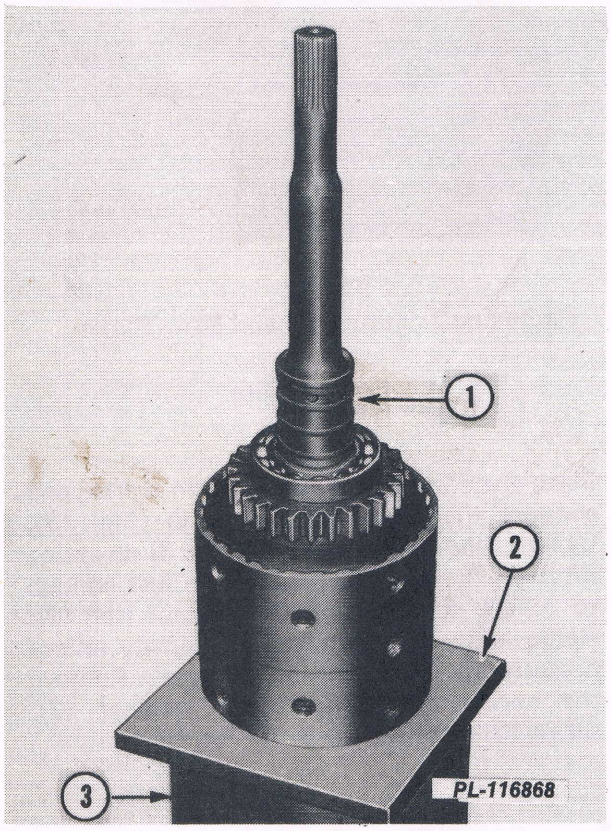

Fig. 7
Clutch Pack Mounted in Work Stand

1. Clutch Pack
2. Adapter Plate
3. Clutch Pack Work Stand

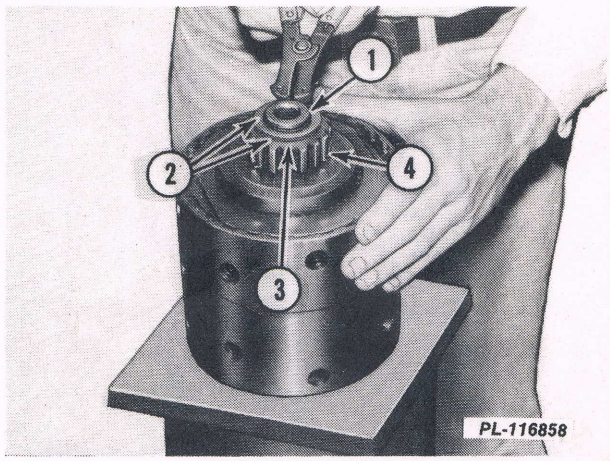

Fig. 8
Removing Snap Ring

1. Snap Ring
2. Bearing Races
3. Needle Thrust Bearing
4. Forward Drive Gear

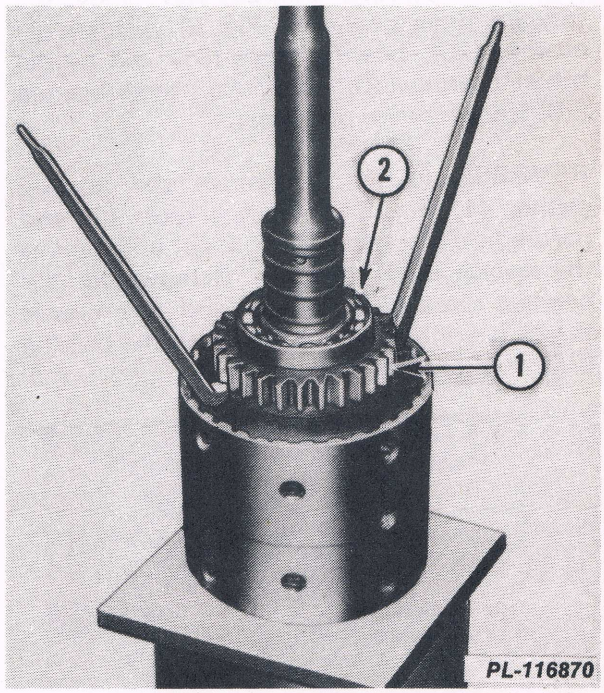

Fig. 9
Removing Oil Distributing Housing Bearing

1. Reverse Drive Gear
2. Oil Distributing Housing Bearing

4. Place a screwdriver in slot of the spiral retainer ring and pull out of groove. Using pliers remove the spiral retainer ring (1, Fig. 10).

(continued on next page)

CLUTCH PACK

DISASSEMBLY

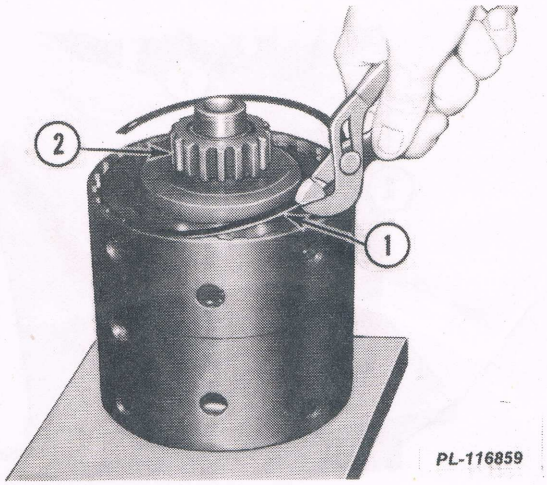

Fig. 10
Removing Spiral Retainer Ring

1. Spiral Retaining Ring
2. Forward Drive Gear

5. FORWARD PACK: Pull out and remove the forward drive gear (19, Fig. 6) with needle bearing (20), bearing races (31) and needle thrust bearing (30). Remove needle bearing (20) from forward drive gear.

5. REVERSE PACK: Remove the backup washer (1, Fig. 11), bearing races (2) and needle thrust bearing (3). Pull out and remove the reverse drive gear (4). Remove the rear bearing races (27, Fig. 6) and rear needle thrust bearing (26). Remove needle bearing (22) from reverse drive gear.

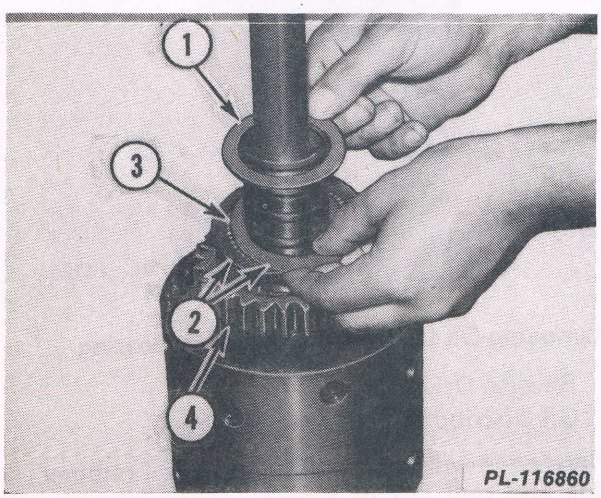

Fig. 11
Reverse Drive Gear Removal

Legend for Figure 11.

1. Backup Washer
2. Bearing Races
3. Needle Thrust Bearing
4. Reverse Drive Gear

6. Remove the support plate (15, Fig. 6). Remove the friction discs (1, Fig. 12) and drive plates (2).

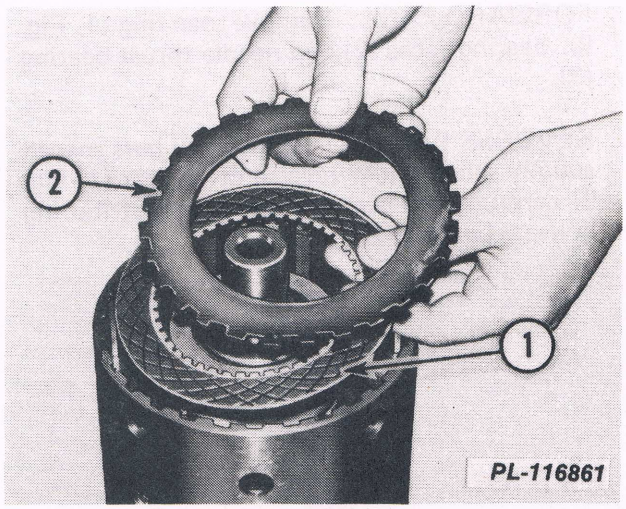

Fig. 12
Removing Friction Disc and Drive Plates

1. Friction Disc
2. Drive Plate

7. Place the clutch pack assembly in a press and support the clutch as shown in (Fig. 13). Using spring compressor tool (Fig. 3) on spring retainer (1, Fig. 13) press down just enough to relieve the pressure on retainer ring (2). Remove the retainer ring (2). Slowly relieve pressure on the spring compressor. Remove the spring compressor tool, retainer (2), spring (3) and lube sleeve (9, Fig. 6).

CAUTION: The spring under the retainer is under considerable pressure. Use due caution while removing. Keep out from above the clutch pack.

DISASSEMBLY

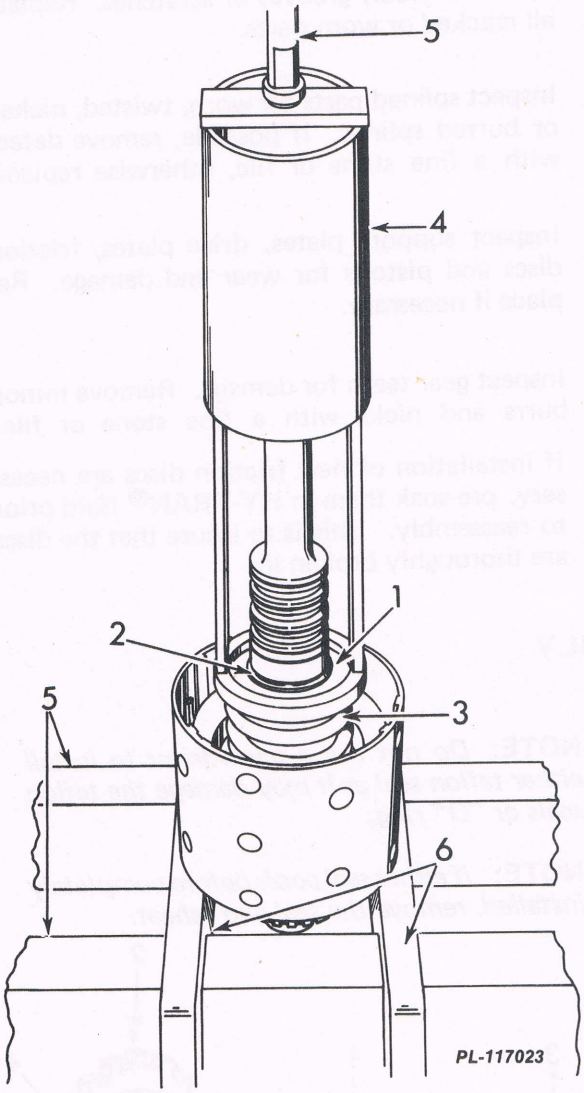

Fig. 13
Spring Compressor

1. Spring Retainer
2. Retainer Ring
3. Spring
4. Spring Compressor Tool
5. Press
6. Supports

8. Remove piston (8, Fig. 6) by using compressed air. Insert an air nozzle at either port as shown in (Fig. 14).

9. Remove the teflon seals (4 and 6, Fig. 6) and "O" rings (5 and 7) from pistons (8) and clutch pack input shaft (1, Fig. 15).

10. Inspect the coupling (16, Fig. 6) carefully for damage. If removal is necessary, torch the coupling off, being careful not to damage the clutch hub (2) or input shaft (1).

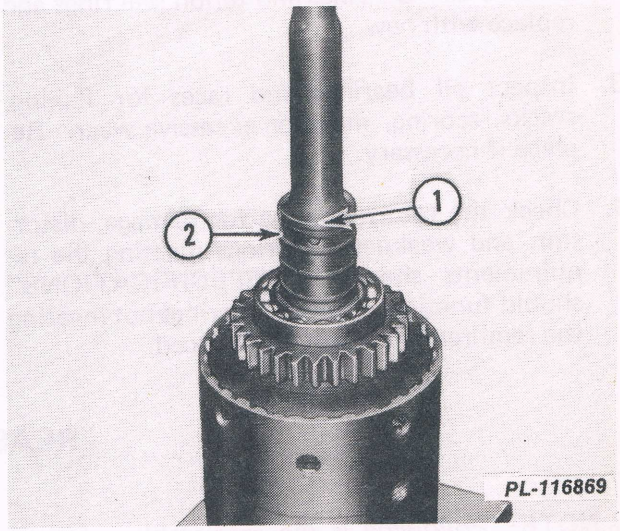

Fig. 14
Ports Used in Removal of Pistons

1. Forward Port
2. Reverse Port

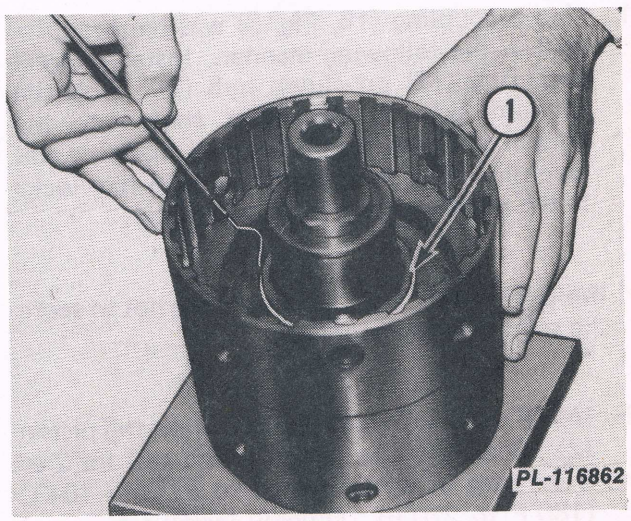

Fig. 15
Removing Teflon Seals and "O" Ring

CLUTCH PACK

INSPECTION AND REPAIR

1. Clean all parts in a commercial solvent and dry with compressed air. Be sure to flush the clutch pack oil passages.

   IMPORTANT: Do not use compressed air to dry the friction discs. Drip dry only. Compressed air may cause the discs to flake off.

2. Discard all "O" rings and teflon seal rings and replace with new.

3. Inspect all bearings and races for flaking, cracks, scoring, nicks or excessive wear. Replace if necessary.

4. Check the return springs for damage, distortion and weakness. Springs meeting the requirements shown in "SPECIFICATIONS" should function properly. Springs not meeting the requirements must be replaced.

5. Inspect case parts for cracks. Check bearing bores for wear, grooves or scratches. Replace all cracked or worn parts.

6. Inspect splined parts for worn, twisted, nicked or burred splines. If possible, remove defect with a fine stone or file, otherwise replace.

7. Inspect support plates, drive plates, friction discs and pistons for wear and damage. Replace if necessary.

8. Inspect gear teeth for damage. Remove minor burrs and nicks with a fine stone or file.

9. If installation of new friction discs are necessary, pre-soak them in HY-TRAN® fluid prior to reassembly. This is to insure that the discs are thoroughly broken in.

REASSEMBLY

NOTE: *Following is the reassembly procedure for the forward and/or reverse clutch pack. Any difference in reassembly between either the forward pack or reverse pack are noted.*

1. If the coupling (16, Fig. 6) was removed, install in the following manner. Install internal snap ring (17) on clutch hub (2). Slide the forward side of the input shaft into the coupling. Compress the internal snap ring and carefully slide shaft until the snap ring locks in the middle groove in the coupling.

   IMPORTANT: Care must be taken not to score the splines of the coupling.

2. Install new "O" ring (1, Fig. 16) on the piston (2). Soak the new piston teflon seal for 2 to 3 minutes in water heated to 82°C to 104°C (180°F to 220°F). Quickly install teflon seal (3) over "O" ring by catching one side in the groove (4) and then work the seal around the piston into the groove. Compress the teflon seal to the piston using a ring compressor until cool.

NOTE: *Do not use a screwdriver to install either teflon seal as it may damage the teflon seals or "O" ring.*

NOTE: *If either seal cools before completely installed, remove the seal and reheat.*

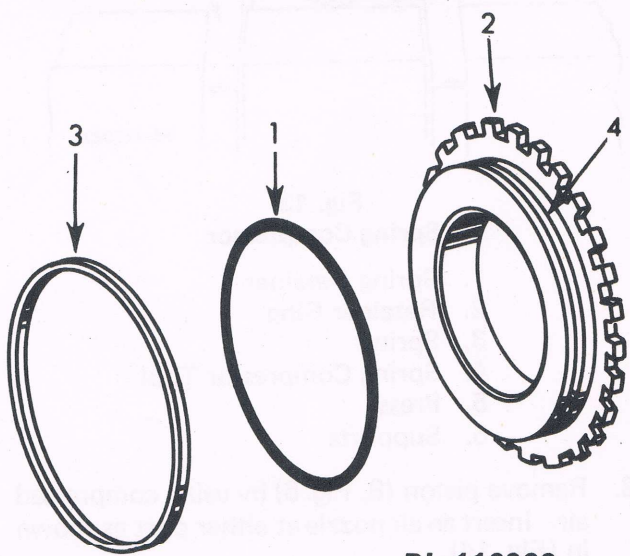

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Fig. 16
Installation of Teflon Seal and "O" Ring on Piston

REASSEMBLY

Legend for Figure 16.

1. "O" Ring
2. Piston
3. Teflon Seal
4. Groove in Piston

3. Install new "O" ring on the clutch hub. Refer to (Fig. 17). Soak the input shaft teflon seal (1, Fig. 17) for 2 to 3 minutes in water preheated to 82°C to 104°C (180°F to 220°F). Quickly install teflon seal over "O" ring by catching one side in the groove and then work the seal around the input shaft into the groove. Compress the teflon seal to the shaft using a ring compressor until cool.

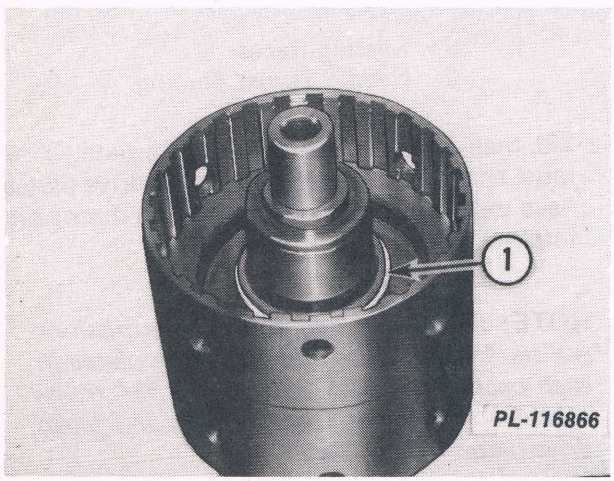

Fig. 17
Installation of Teflon Seals and "O" Rings on Clutch Hub

4. Install the piston (with teflon seals facing clutch hub) into the clutch pack pressing down evenly until it bottoms. Refer to Fig. 18.

5. Place the clutch pack in a press and support the clutch as shown in (Fig. 20). Install the lube sleeve (9, Fig. 6), spring (3, Fig. 20) and spring retainer (1) into clutch pack.

NOTE: *The retainer ring on the reverse pack side must be installed on the clutch shaft first before compressor tool is used. Refer to (Fig. 19).*

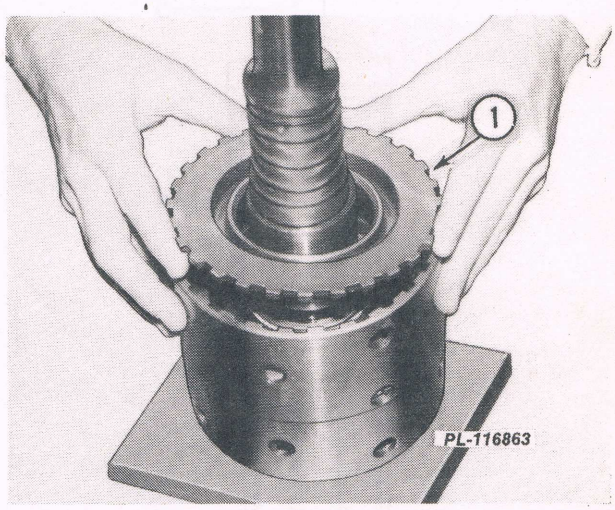

Fig. 18
Installing Piston in Clutch Pack

Install spring compressor tool (Fig. 3) and press down spring retainer (1, Fig. 20) just enough to install retainer ring (2).

CAUTION: The spring under the retainer will be under considerable pressure. Use due caution while installing. Keep out from above the clutch pack. When installing retainer ring make sure it is securely locked in its groove before compressor tool is removed from spring retainer.

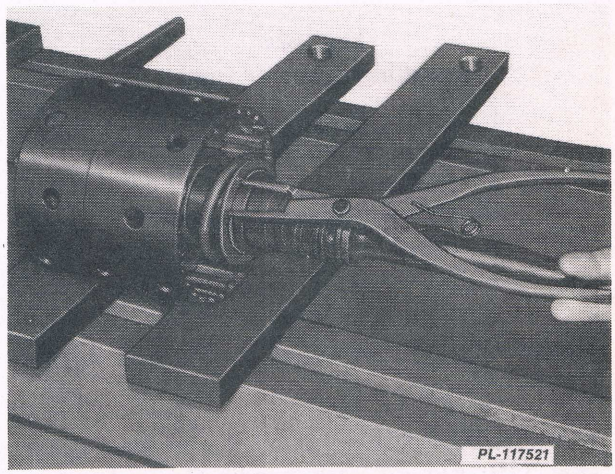

Fig. 19
Installing Retainer Ring on Reverse Pack Side of Input Shaft

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CLUTCH PACK

REASSEMBLY

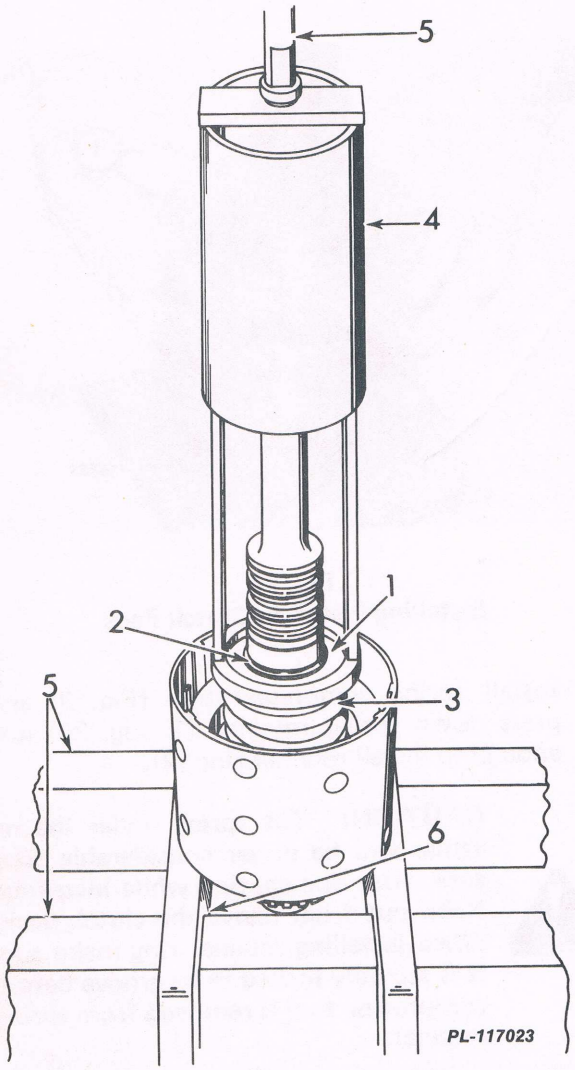

Fig. 20
Installing Retainer Ring

1. Spring Retainer
2. Retainer Ring
3. Spring
4. Spring Compressor Tool
5. Press
6. Supports

6. Install bearing races (1, Fig. 21) and needle thrust bearing (2).

7. FORWARD PACK: Install the forward drive gear (19, Fig. 6) with needle thrust bearing (20) in the clutch pack.

8. Install the friction discs (13, Fig. 6) and drive plate (14). Begin with a friction disc (1, Fig. 22) then a drive plate (2) and alternate. You must end with a friction disc. The drive plates have external teeth and the friction discs have internal teeth.

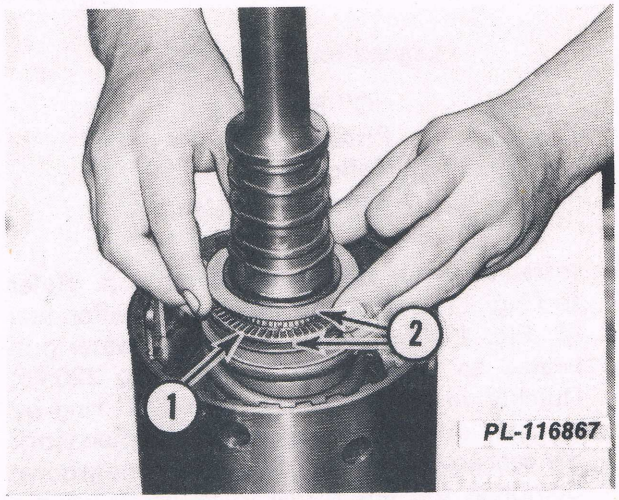

Fig. 21
Installing Bearing Races and Needle Thrust Bearing

1. Bearing Races
2. Needle Thrust Bearing

NOTE: *The 240A and 4500B transmissions use six friction discs and five drive plates in each pack. The 250A, 260A and 270A transmissions have eight friction discs and seven drive plates in each pack.*

NOTE: *The friction discs and drive plates do not have a right or wrong side when placing them in the clutch housing. Put a small amount of clean HY-TRAN® fluid between each disc and plate when placing them in the housing.*

9. Install support plate (2, Fig. 23) with notch side facing away from clutch pack.

10. Install the spiral retainer ring (1, Fig. 23). Insert pointed end in and push around the clutch pack.

11. FORWARD PACK: Install the bearing races (2, Fig. 24), needle thrust bearing (3) and snap ring (1).

CLUTCH PACK

REASSEMBLY

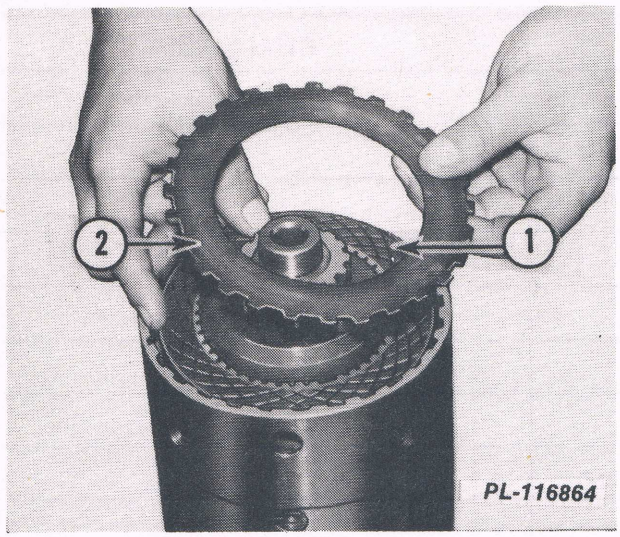

Fig. 22
Installing Friction Disc and Drive Plates

1. Friction Disc
2. Drive Plates

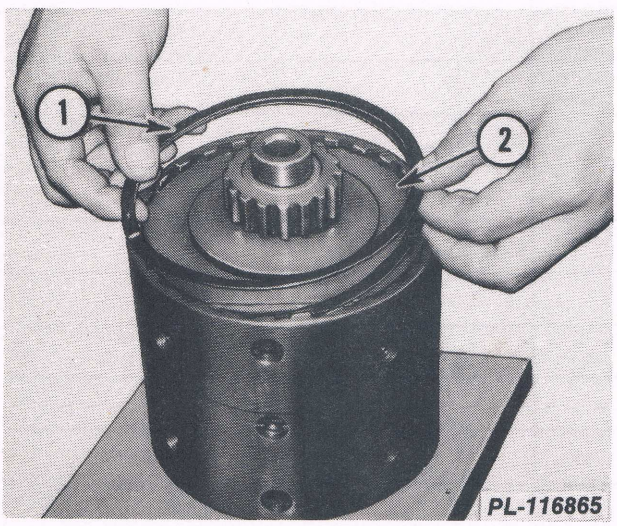

Fig. 23
Installing Spiral Retainer Ring

1. Spiral Retainer Ring
2. Support Plate

12. REVERSE PACK: Align the friction discs (13, Fig. 6) using a thin blade screwdriver and install reverse drive gear (21). It will be necessary to rotate the gear so it meshes with friction discs. Push the gear down until it bottoms.

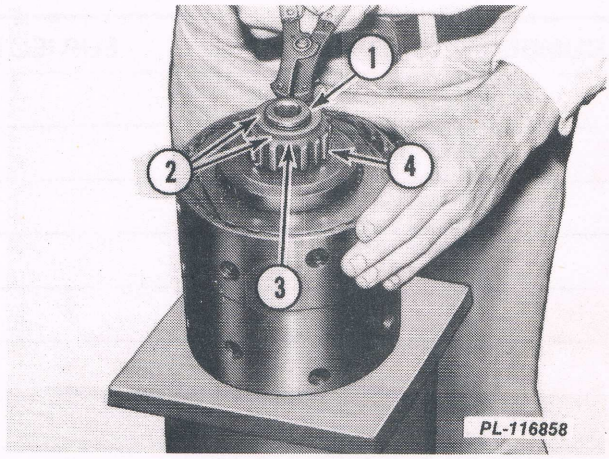

Fig. 24
Installing Snap Ring

1. Snap Ring
2. Bearing Races
3. Needle Thrust Bearing
4. Forward Drive Gear

13. REVERSE PACK: Install the bearing races (2, Fig. 25), needle thrust bearing (3) and backup washer (1).

14. REVERSE PACK: Heat the oil distributing housing bearing (28, Fig. 6) and install on shaft until it bottoms against backup washer (29).

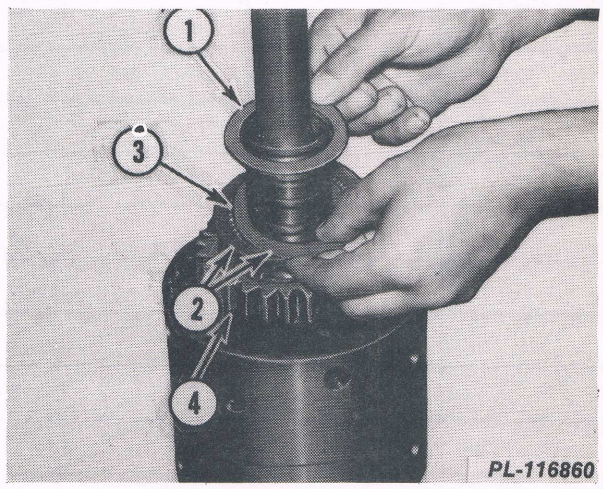

Fig. 25
Final Reverse Pack Installation

1. Backup Washer
2. Bearing Races
3. Needle Thrust Bearing
4. Reverse Drive Gear

CLUTCH PACK

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

VALVES

CONTENTS

VALVES

SPECIFICATIONS

SPRING TEST LOAD DATA

Description	No. of Coils	Free Length	Test Length	Test Load Pressure
Dump and modulation control valve				
Directional spool detent springs	14	27.9mm (1.1 in.)	16.5mm (0.65 in.)	1.8 kg (4 lbs.)
Main regulating valve spring	8.5	73.6mm (2.9 in.)	40.6mm (1.6 in.)	28.9 kg (63.8 lbs.)
Regulating relief valve spring	13.5	55.8mm (2.2 in.)	38.1mm (1.5 in.)	4.5 kg (10 lbs.)
Regulating junction valve				
Relief valve spring	21	33.1mm (1.5 in.)	25.4mm (1 in.)	1.5 kg (3.3 lbs.)

PRESSURES

Dump and modulation control valve	
Main regulating valve setting	551.5 to 1482.4 kPa (80 to 215 psi)
Regulating relief valve setting	above 551.5 kPa (80 psi)
Regulating junction valve	
Relief valve setting	210 kPa (30 psi)

DUMP AND MODULATION CONTROL VALVE

DESCRIPTION

The dump and modulation control valve supplies a constant fluid flow to the torque converter unit. When the forward-reverse directional spool is actuated, fluid flow is supplied to the corresponding side of the clutch pack. It also acts as a return to dump when the dump pedal is depressed or when the forward-reverse directional lever is put in neutral.

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DUMP AND MODULATION CONTROL VALVE

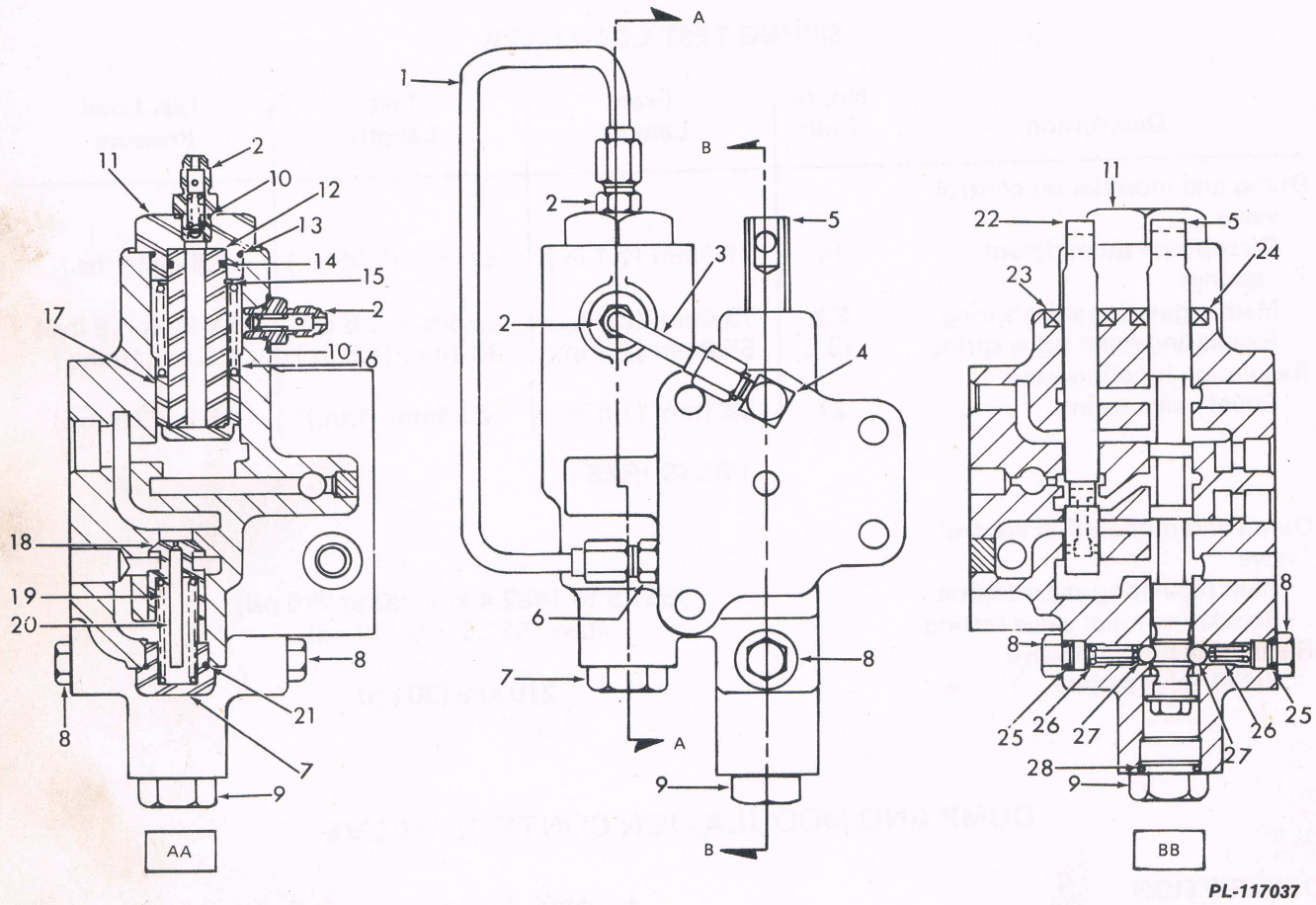


Fig. 1
Cross Section Dump and Modulation Control Valve

1. Reverse Modulator Tube
2. Union Orifice
3. Forward Modulator Tube
4. Elbow
5. Forward/Reverse Directional Spool
6. Connector
7. Plug
8. Plug
9. Plug
10. "O" Ring
11. Union Plug
12. Piston
13. "O" Ring
14. "O" Ring
15. Retainer Ring
16. Spring
17. Valve Poppet
18. Valve Poppet
19. Spring
20. Dowel Pin
21. "O" Ring
22. Dump Spool
23. Valve Spool Seal
24. Valve Spool Seal
25. "O" Ring
26. Detent Spring
27. Detent Ball
28. "O" Ring

OPERATION

The dump and modulation control valve has four operating positions.

VALVES

DUMP AND MODULATION CONTROL VALVE

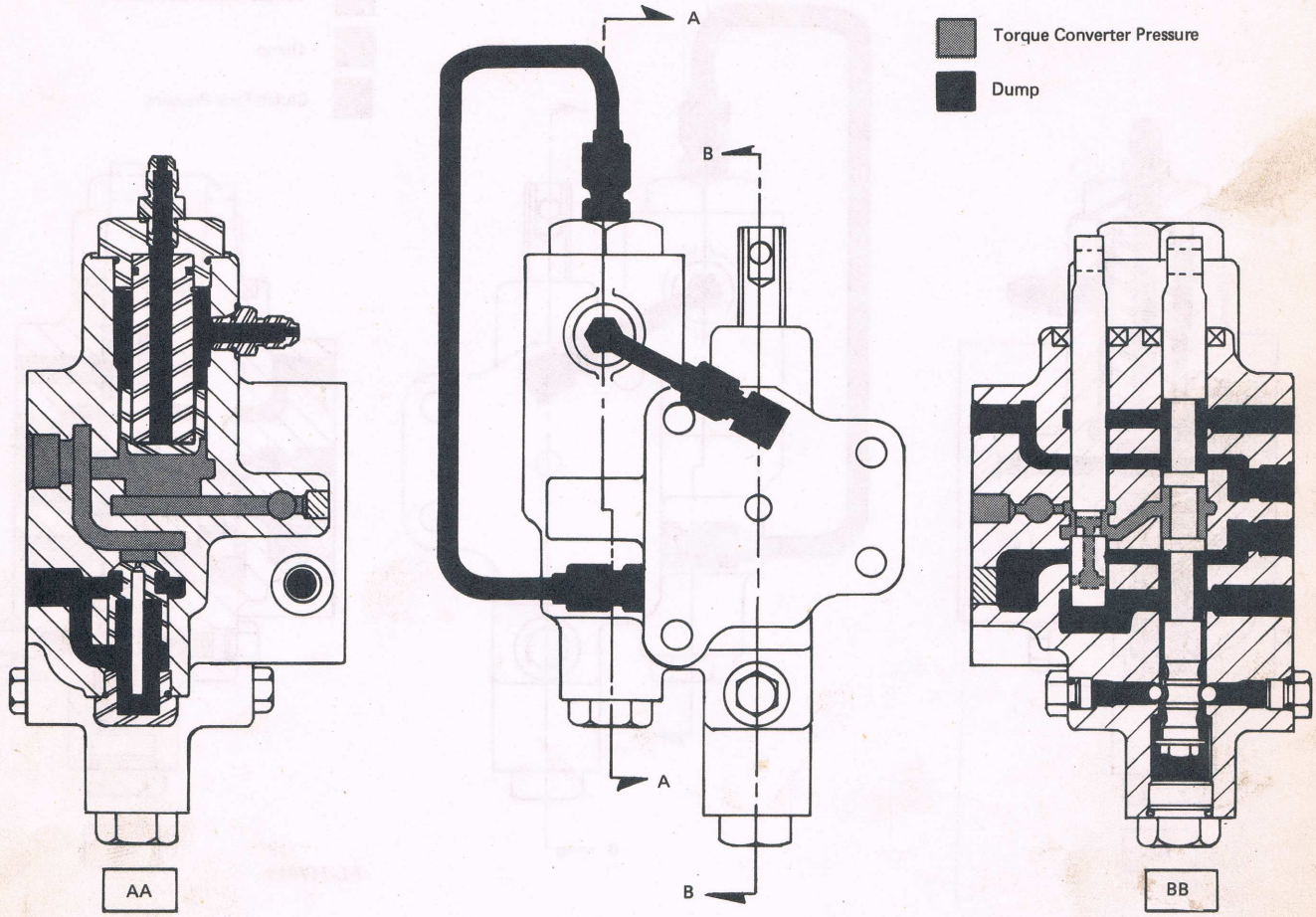


Fig. 2
Neutral Position

NEUTRAL (Refer to Fig. 2)

When the forward-reverse direction spool is engaged in either position the fluid pressure is modulated from 551.5 kPa (80 psi) to 1103.1 kPa (160 psi) which is the maximum pressure required to achieve clutch lock-up at the stall condition of the engine-converter combination. Pressure is further increased to 1482.37 to 1516.84 kPa (215 to 220 psi) to insure that there is no slippage after the clutch is locked up. When the spool is in engagement the appropriate passage is opened to the clutch pack. Another passage leads to the main regulating valve which produces the modulation needed for shifting. As fluid

FORWARD OR REVERSE DIRECTION (Refer to Figs. 3 or 4)

When the dump and modulation control valve is in the neutral position fluid from the charge pump is supplied through the valve to the torque converter unit at a stand by pressure of 551.5 kPa (80 psi). The lands on the control valve spools are located so that no fluid is transferred to the passage leading to either the forward or reverse side of the clutch pack. There is a spring loaded relief valve located in the passage to the torque converter inlet port that will open when the pressure in the passage is greater than 551.5 kPa (80 psi). The relief valve will close when the pressure lowers to 551.5 kPa (80 psi). All other passages act as return to dump.

(continued on next page)

VALVES

DUMP AND MODULATION CONTROL VALVE

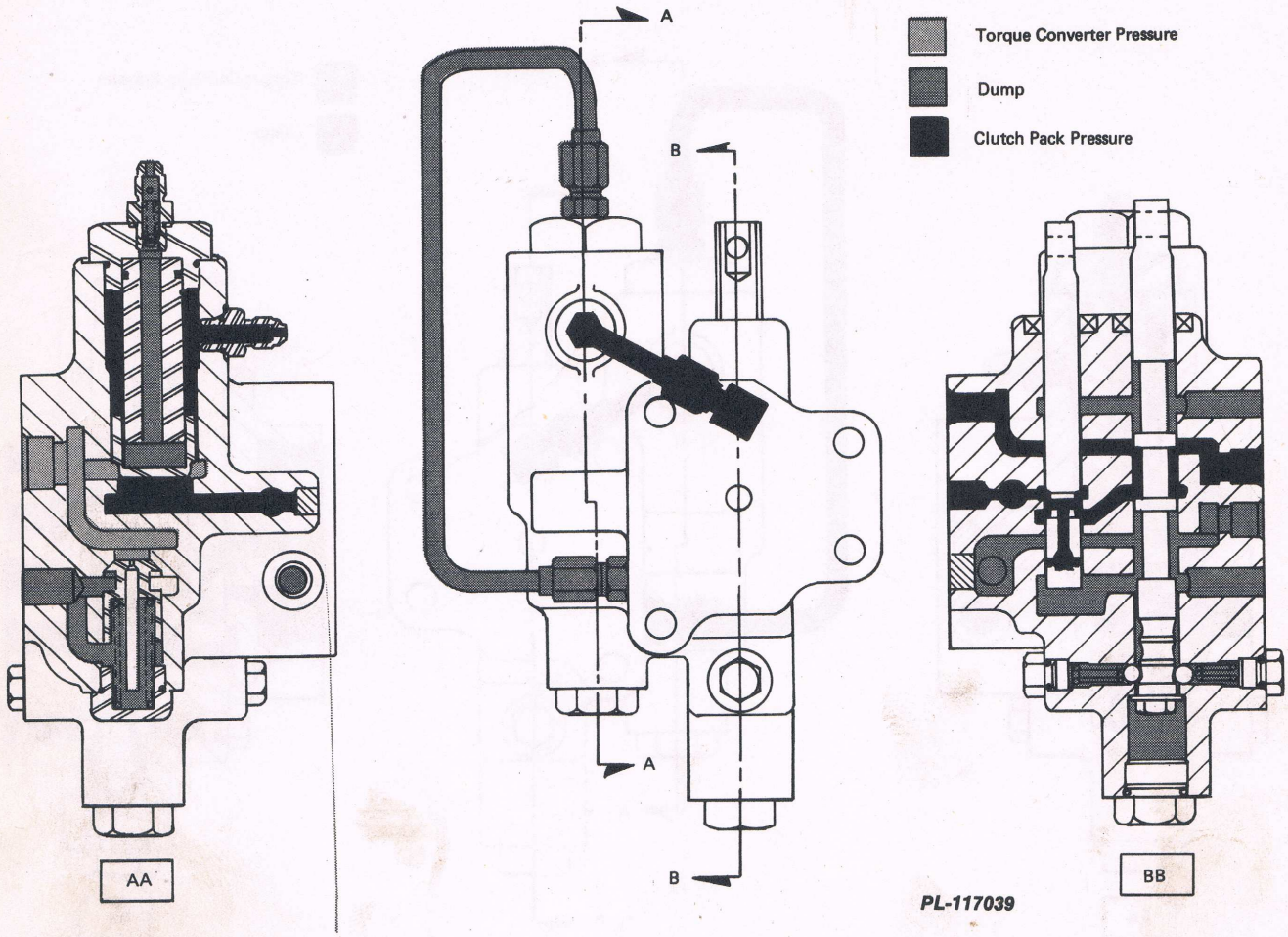


Fig. 3
Forward Position

FORWARD OR REVERSE DIRECTION (Continued)

enters the main regulating valve, it moves the valve down restricting fluid entering the torque converter passage. The fluid entering the torque converter unit is still 551.5 kPa (80 psi) but because of restriction by the regulating valve fluid now entering the clutch pack is at 1448-1516 kPa (215-220 psi). Modulation is accomplished by the time it takes the fluid to actuate the main regulating valve to cause restriction in fluid flow (approximately 1 or 2 seconds).

VALVES

DUMP AND MODULATION CONTROL VALVE

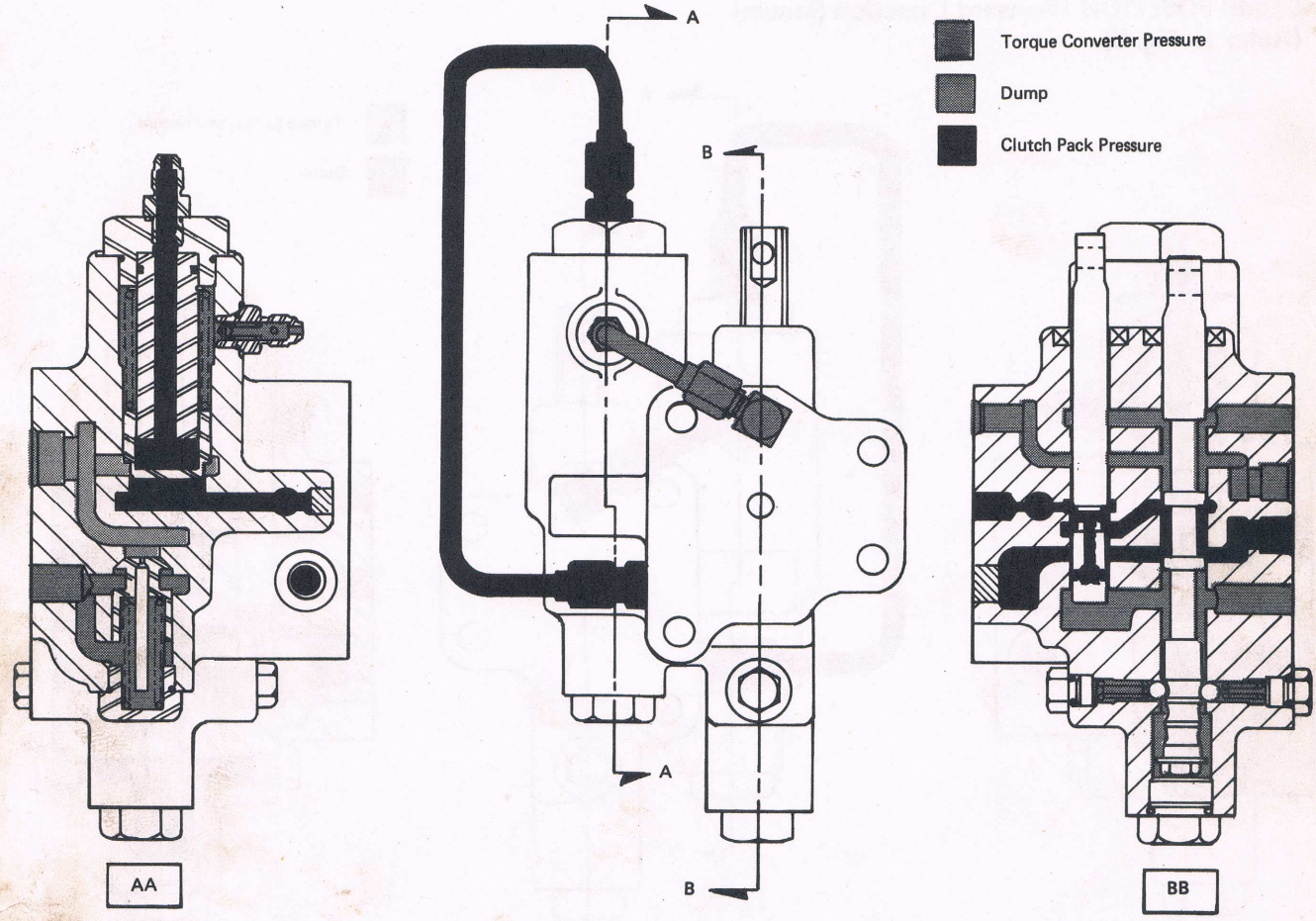


Fig. 4
Reverse Position

VALVES

DUMP AND MODULATION CONTROL VALVE

DUMP POSITION (Forward Direction Shown)
(Refer to Fig. 5)

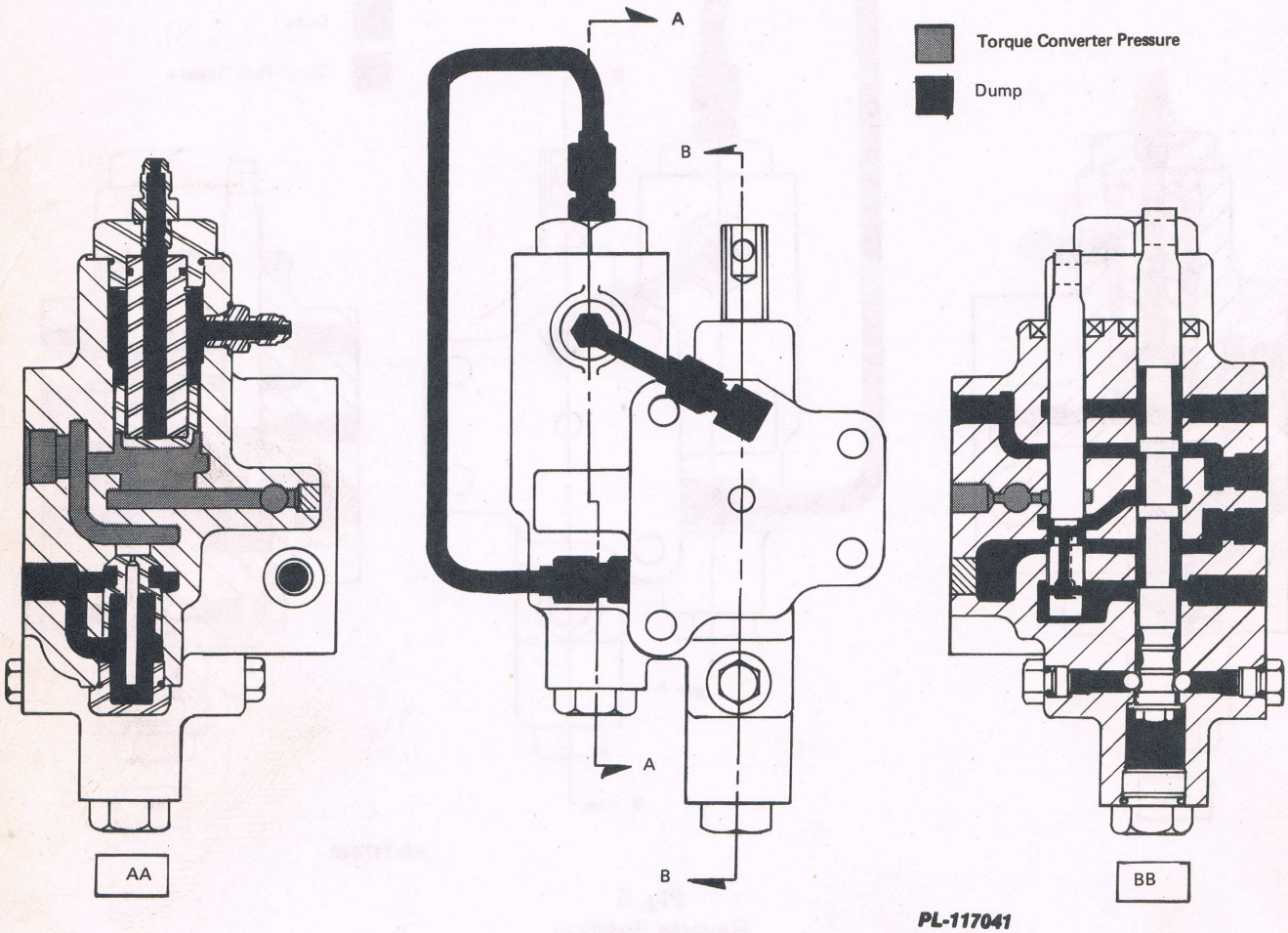


Fig. 5
Dump Position (Forward Direction)

OPERATION (Continued)
DUMP POSITION (Forward Direction Shown) (Refer to Fig. 5) (Continued)

When the dump spool is engaged, fluid entering the valve is blocked from all passages except the torque converter passage. Within the dump spool there is an internal passage which allows fluid from the clutch pack (now, not under pressure) to return to sump. Fluid in the main regulator valve is released through the orifice union back to sump. The dump and modulation control valve and the transmission is in a neutral stage.

DISASSEMBLY (Refer to Fig. 6)

1. Disassemble the control valve in the sequence indicated by reference numbers in (Fig. 6).

DUMP AND MODULATION CONTROL VALVE

DISASSEMBLY (Continued)

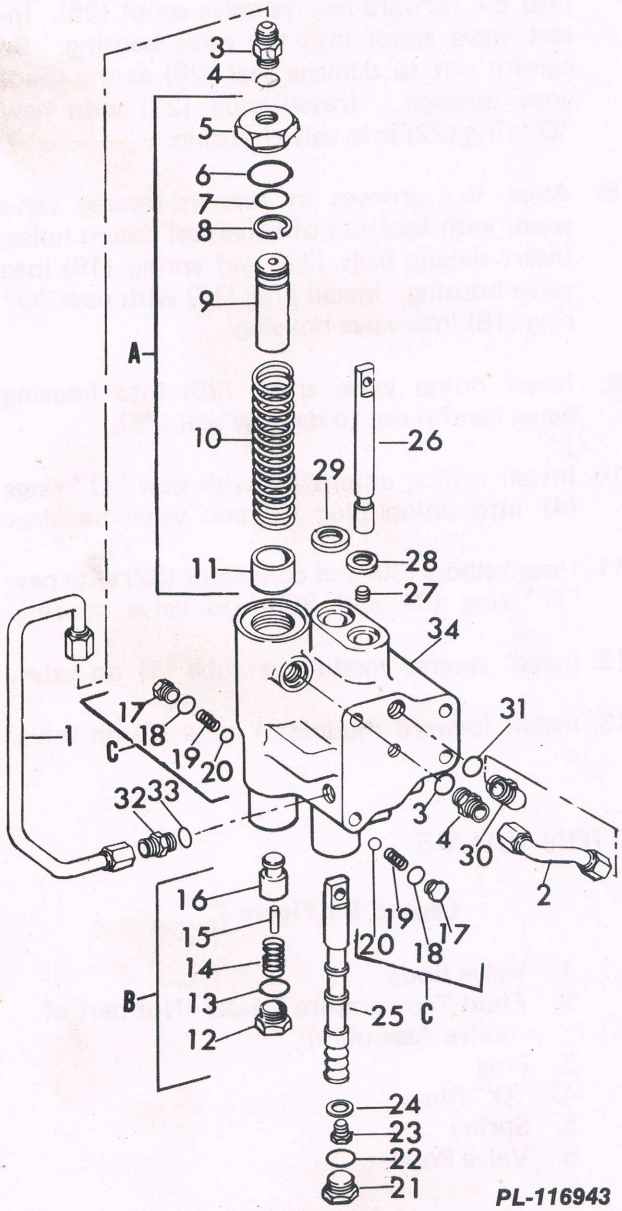


Fig. 6
Exploded View of Dump and Modulation Control Valve

A. Main Regulating Valve
B. Relief Valve
C. Directional Valve Spool Detent
1. Reverse Modulator Tube
2. Forward Modulator Tube
3. Orifice Union
4. "O" Ring
5. Union Plug
6. "O" Ring

Legend for Figure 6. (Continued)

7. "O" Ring
8. Retainer Ring
9. Piston
10. Spring
11. Valve Poppet
12. Plug
13. "O" Ring
14. Spring
15. Dowel Pin
16. Valve Poppet
17. Plug
18. "O" Ring
19. Detent Spring
20. Detent Ball
21. Plug
22. "O" Ring
23. Bolt
24. Washer
25. Forward-Reverse Valve Spool
26. Dump Valve Spool
27. Do not remove from valve spool
28. Valve Spool Seal
29. Valve Spool Seal
30. Elbow
31. "O" Ring
32. Connector
33. "O" Ring
34. Valve Housing

INSPECTION AND REPAIR

1. Clean all parts in commerical cleaning solvent and dry with compressed air.

2. Check all springs for damage, distortion and weakness. Springs meeting the requirements shown in "SPECIFICATIONS" should function properly. Springs not meeting the requirements must be replaced.

3. Inspect the valve body bores and spools for grooves, deep scratches or excessive wear. If a spool is loose in its bore or if the valve body is cracked or has damaged bores the complete valve should be replaced.

4. Discard all "O" rings, seals, and gaskets and replace with new.

VALVES

DUMP AND MODULATION CONTROL VALVE

REASSEMBLY (Refer to Fig. 6)

1. Insert valve poppet (16) into the valve housing (34) with spring (14) and dowel pin (15). Install plug (12) with new "O" ring (13) into valve housing.

2. Insert valve poppet (11) and spring (10) into valve housing.

3. Install retaining ring (8) in the bottom groove of the piston (9). Install new "O" ring (7) into the top groove of the piston.

4. Insert piston with "O" ring side up into the valve housing.

5. Install new "O" ring (6) onto the union plug (5). Install union plug into valve housing being sure that the piston sits squarely inside union plug.

6. Install valve spool seals (28 and 29) into the valve housing being careful not to damage seals in the process.

7. If removed, install bolt (23) and washer (24) into the forward-reverse valve spool (25). Insert valve spool into the valve housing. Be careful not to damage seal (29) as the spool goes through. Install plug (21) with new "O" ring (22) into valve housing.

8. Align the grooves in forward-reverse valve spool with location of valve seal detent holes. Insert detent balls (20) and spring (19) into valve housing. Install plug (17) with new "O" ring (18) into valve housing.

9. Insert dump valve spool (26) into housing being careful not to damage seal (28).

10. Install orifice unions (3) with new "O" rings (4) into union plug (5) and valve housing.

11. Install elbow (30) and connector (32) with new "O" ring (31 and 32) into valve housing.

12. Install reverse modulator tube (1) on valve.

13. Install forward modulator tube (2) on valve.

REGULATOR JUNCTION VALVE

DESCRIPTION

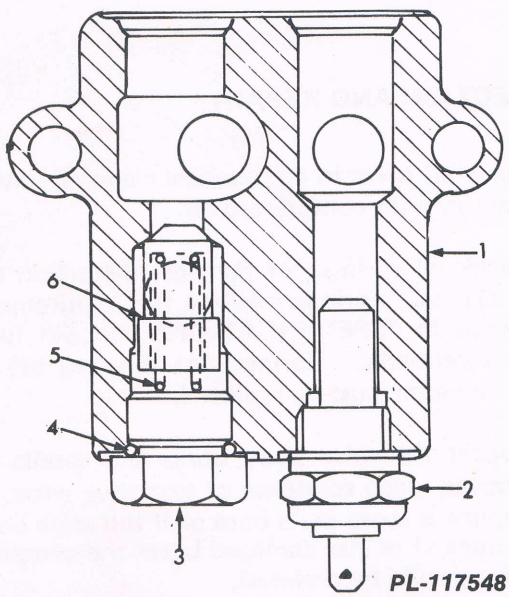


Fig. 7
Cross Section View or Regulator Junction Valve

Legend for Figure 7.

1. Valve Body
2. Fluid Temperature Sender (Not part of Valve Assembly)
3. Plug
4. "O" Ring
5. Spring
6. Valve Poppet

The regulator junction valve acts as a means for the heated torque converter outlet fluid to flow to the oil cooler and back to lube at a regulated pressure.

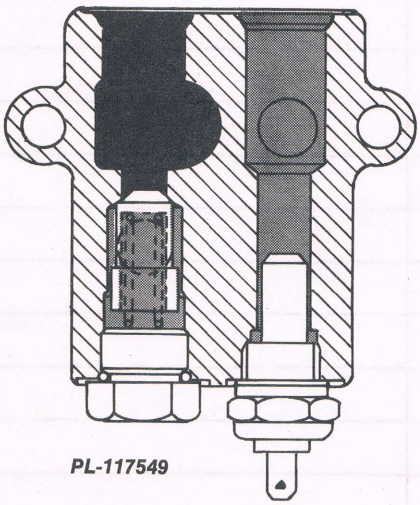
OPERATION (Refer to Fig. 8)

The regulator junction valve has two functions. The first function is to direct heated torque converter outlet fluid to the oil cooler. In the same passage there is a fluid temperature sender (2, Fig. 7) which is connected to the gauge on the

REGULATOR JUNCTION VALVE

OPERATION (Continued)

instrument panel. The seond function is to receive the cooler fluid from the oil cooler and direct it to the clutch pack and speed and range gears for lubrication. This fluid is regulated at 210 kPa (30 psi) by the lube regulator valve.



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DUMP FLUID

TORQUE CONVERTER TO OIL COOLER FLUID

OIL CODER RETURN TO LUBE FLUID

Fig. 8
Regulator Junction Vlave Fluid Flow

DISASSEMBLY

1. Remove plug (2, Fig. 9) and "O" ring (3) from valve body (1).
2. Remove spring (4) and valve poppet (5) from valve body.

INSPECTION AND REPAIR

1. Clean all parts in commercial cleaning solvent and dry with compressed air.

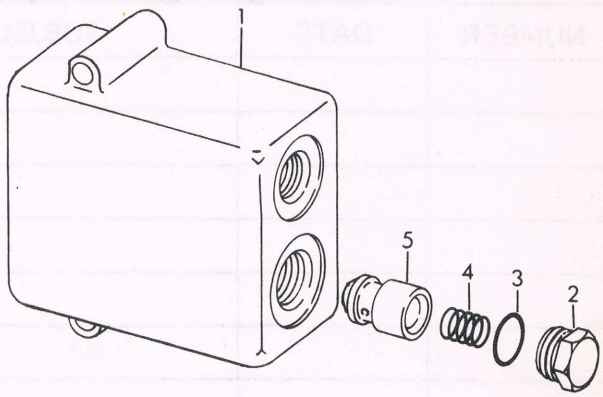

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Fig. 9
Exploded View of Regulator Junction Valve

1. Valve Body
2. Plug
3. "O" Ring
4. Spring
5. Valve Poppet

2. Check the spring for damage, distortion and weakness. A spring meeting the requirements shown in "SPECIFICATIONS" should function properly. If the spring does not meet requirements shown, replace it.
3. Inspect all parts for wear and replace if necessary.
4. Discard the "O" ring and replace with new.

REASSEMBLY (Refer to Fig. 9)

1. Insert valve poppet (5) with spring (4) into valve body (1).
2. Install plug (2) with new "O" ring (3) into valve body.

VALVES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

CHARGE PUMP

CONTENTS

CHARGE PUMP

DESCRIPTION

This is a single element, positive displacement gear type pump. Pump output is used for the dump and modulation control valve. The pump is located in the bottom right front side of the range transmission housing (opposite the internal pump). Both elements of the pump rotate together and are driven off a gear connected to the PTO shaft.

When the engine is running fluid is drawn from the range transmission housing (which serves as one part of the reservoir) through the pump suction screen and into the intake port of the pump. An internal and external pressure line is used to transfer the output to the dump and modulation control valve.

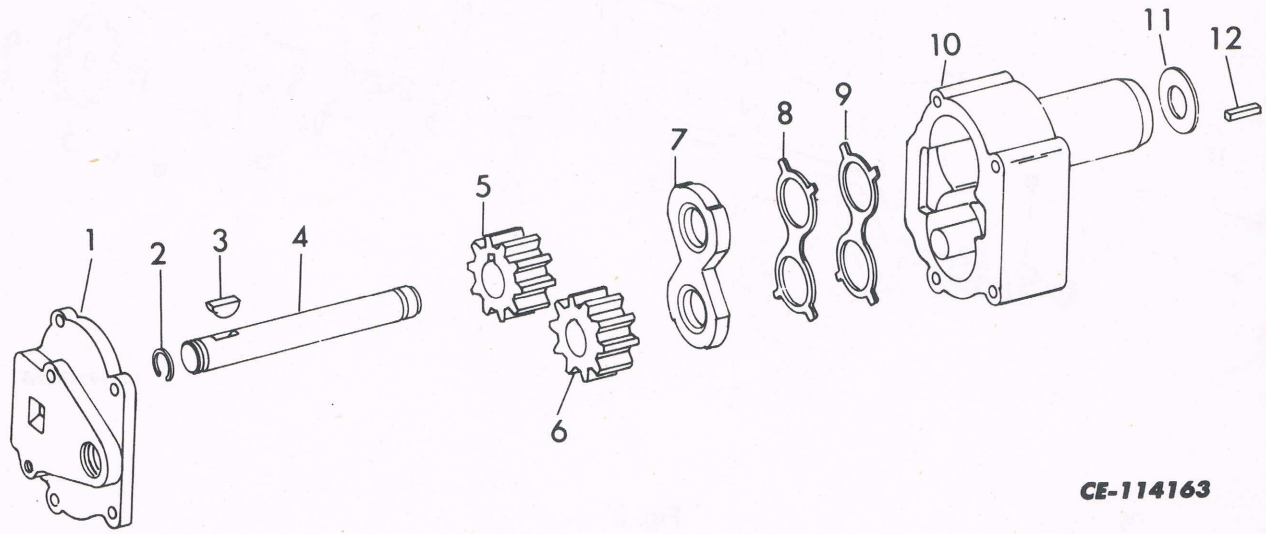


Fig. 1
Exploded View of Charge Pump

1. Rear Cover
2. Snap Ring
3. Woodruff Key
4. Gear Shaft
5. Drive Gear
6. Driven Gear
7. Wear Plate
8. Loading Seal
9. Pressure Loading Seal
10. Pump Body
11. Washer
12. Square Key

OPERATION

As the pump drive shaft and gear are driven, the mated driven gear is turned at the same speed, but in opposite direction. This causes fluid to be carried into the spaces between the gear teeth from the inlet port and discharged into the pressure port.

(continued on next page)

CHARGE PUMP

OPERATION

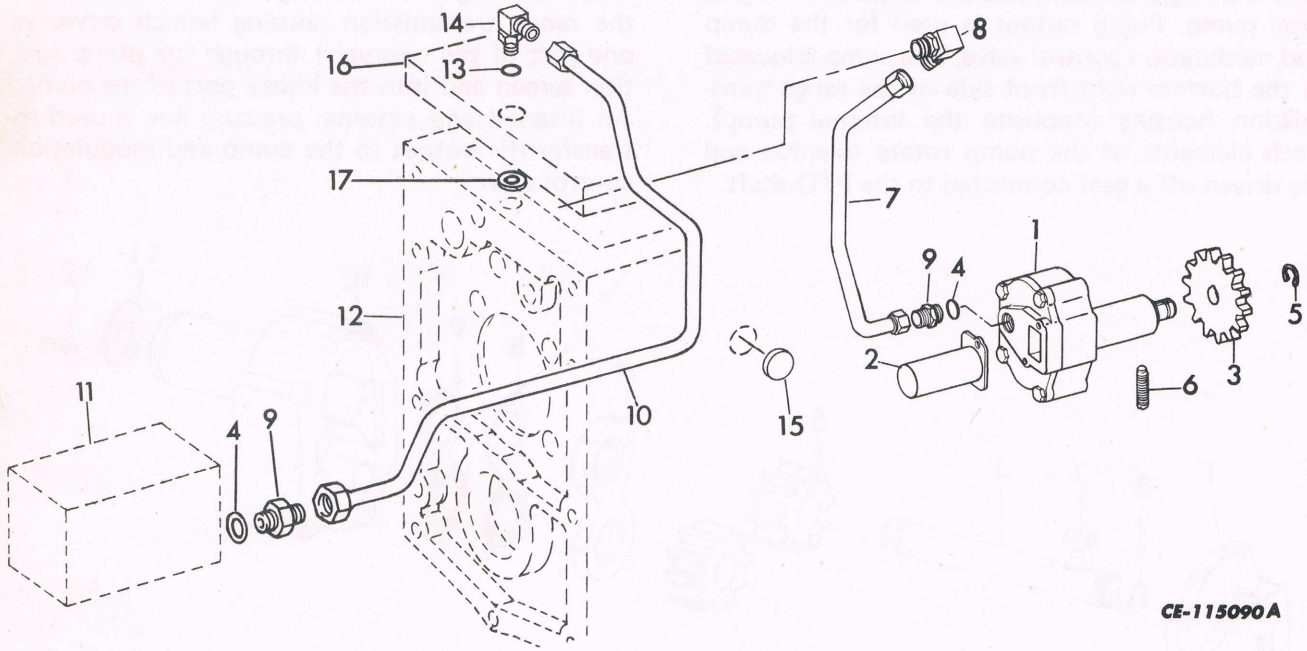


Fig. 2
Charge Pump Connections

1. Charge Pump
2. Suction Screen
3. Pump Drive Gear
4. "O" Ring
5. Snap Ring
6. Set Screw
7. Internal Pressure Tank
8. Elbow
9. Connector
10. External Pressure Tube
11. Dump and Modulation Control Valve
12. Range Transmission Housing
13. "O" Ring
14. Elbow
15. Plug
16. Transmission Housing Cover
17. Teflon Seal

SPECIFICATIONS

CHARGE PUMP

Type. . . . . Gear Drive
Drive . . . . . Gear driven off the PTO shaft from transmission
Capacity. . . . . 42.5 1/min (11.25 GPM) @ 3740 RPM and 1723kPa (250 psi)

SPECIAL TORQUES

Pump rear cover bolts . . . . . 10 N•m (7-8 ft-lbs.)

CHARGE PUMP

DISASSEMBLY

(Refer to Fig. 3)

1. Remove the square key (9) and washer (10) from the pump (1).

2. Remove the suction screen (2, Fig. 2).

3. Place the pump in a vise with the gear shaft (3) down. Remove the four bolts securing rear cover (2). Using a plastic mallet, bump the end of shaft (3) to separate rear cover from pump body. Remove the rear cover.

IMPORTANT: *Punch mark gears for reassembly to assure same wear pattern.*

4. Remove the gear shaft (3), drive gear (4), key (8) and snap ring (7) together.

5. Remove the driven gear (5).

6. Remove wear plate (6) and loading seals (13 and 14) from pump body.

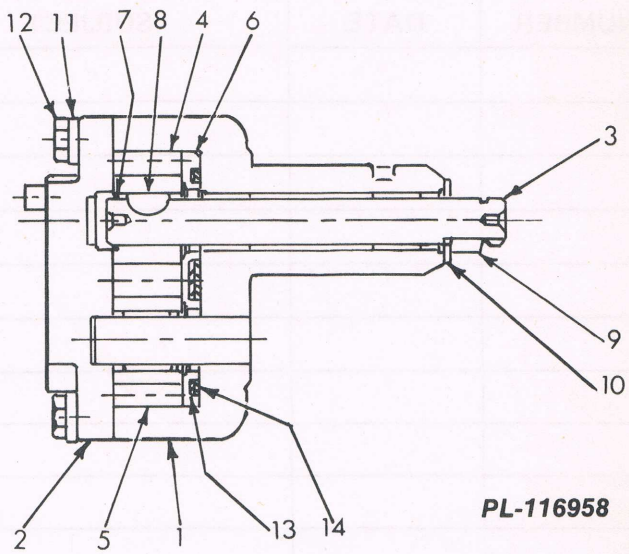


Fig. 3
Cross Section View of Charge Pump

1. Pump Body
2. Rear Cover
3. Gear Shaft
4. Drive Gear
5. Driven Gear
6. Wear Plate
7. Snap Ring
8. Woodruff Key
9. Square Key
10. Washer
11. Washer
12. Bolt
13. Loading Seal
14. Pressure Loading Seal

INSPECTION AND REPAIR

1. Thoroughly clean the pump parts in a clean, suitable solvent. Carefully inspect the parts for damage or wear. Repair of the pump is limited to items (6, 7, 8, 9, 10, 13 and 14) of Fig. 3. Damage to any other parts of the pump will require replacement of the entire pump.

2. Discard seals (13 and 14) and replace with new.

REASSEMBLY

1. Install loading seal (13, Fig. 3) into the groove in wear plate (6). Install pressure loading seal (14) on top of loading seal (13) in wear plate.

NOTE: *Both seals (13 and 14) must fit inside the lip of wear plate.*

2. Install wear plate into the pump body with seals facing down.

3. Dip drive gear (4) with gear shaft (3), key (8) and snap ring (7) attached into HY-TRAN® fluid and install in pump body.

4. Dip driven gear (5) into HY-TRAN® fluid and install in pump body. Be sure punch marks line up.

5. Install rear cover on pump body. Torque the bolts to 10 N•m (7-8 ft-lbs.).

6. Install washer (10) and square key (9) to the end of gear shaft (3).

CHARGE PUMP

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

HYDRAULICS

CONTENTS

HYDRAULICS

GENERAL

The complete hydraulic system consists of the charge pump, dump and modulation control valve, torque converter unit, regulator junction valve, oil cooler and lubrication circuits. These systems are interconnected to share a common reservoir and hydraulic supply pump.

OPERATION

(Refer to Figs. 1 and 2)

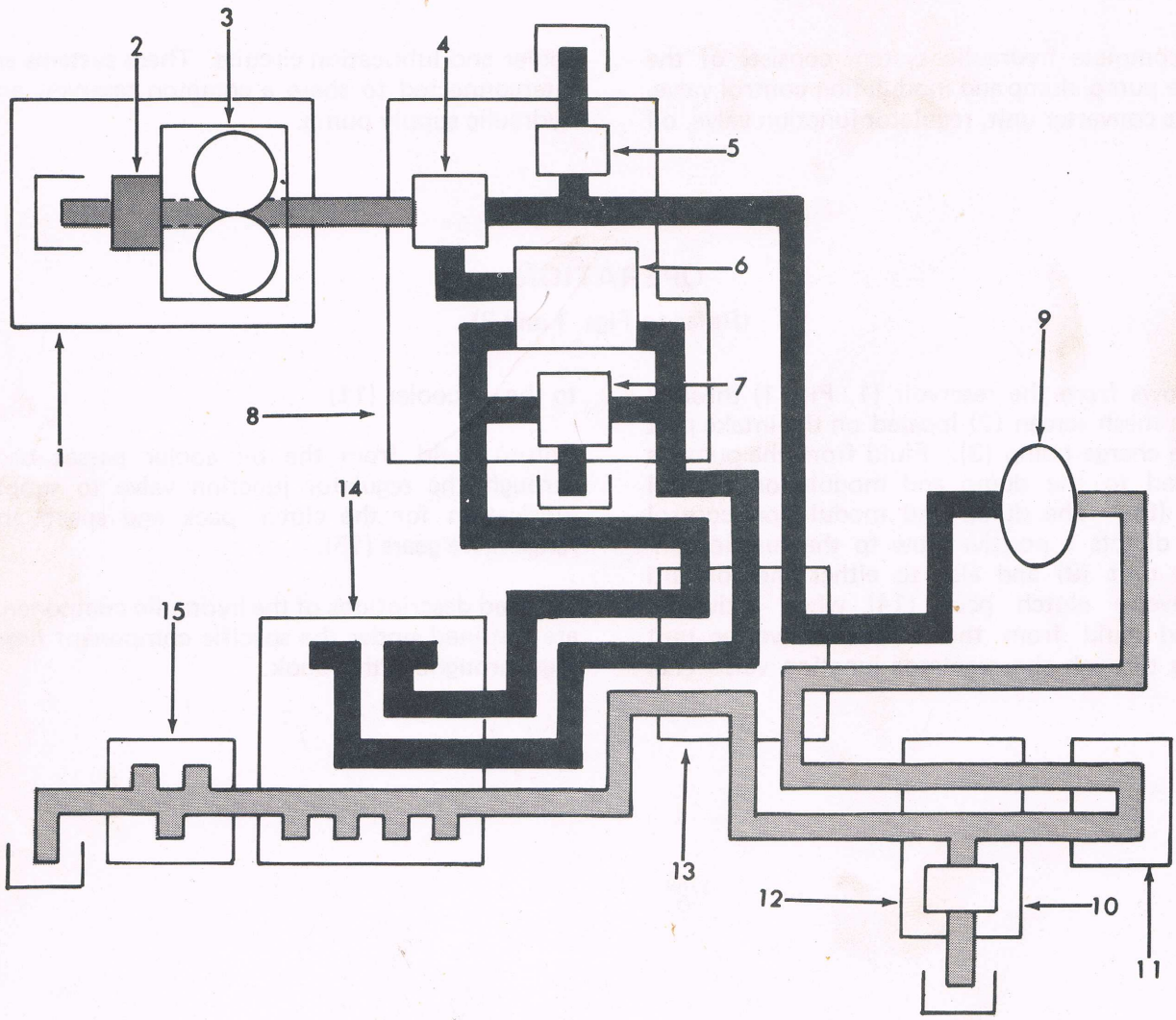
Oil flows from the reservoir (1, Fig. 1) through a wire mesh screen (2) located on the intake part of the charge pump (3). Fluid from the pump is directed to the dump and modulation control valve (8). The dump and modulation control valve directs a positive flow to the torque converter unit (9) and also to either the forward or reverse clutch pack (14) when activated. Heated fluid from the torque converter unit passes through the regulator junction valve (12) to the oil cooler (11).

Return fluid from the oil cooler passes back through the regulator junction valve to supply lubrication for the clutch pack and speed and range drive gears (15).

Detailed descriptions of the hydraulic components are outlined under the specific component headings throughout this book.

HYDRAULICS

OPERATION



Torque Converter Return and Lube Pressure 210kPa(30psi)

Pump to Control Valve Pressure 1378kPa(200psi)42l/min(11gpm)

Torque Converter Pressure 550kPa(80psi)15l/min(4gpm)

PL-117026

Fig. 1
Hydraulic Circuitry in Neutral (Block Form)

1. Reservoir
2. Screen
3. Charge Pump
4. Main Regulating Valve
5. Converter Regulating Valve
6. Forward-Reverse Valve Spool
7. Dump Spool
8. Dump and Modulation Control Valve
9. Torque Converter Housing
10. Lube Regulator Valve
11. Oil Cooler
12. Regulator Junction Valve
13. Oil Distributing Housing
14. Forward-Reverse Clutch Pack
15. Speed and Range Drive Gears

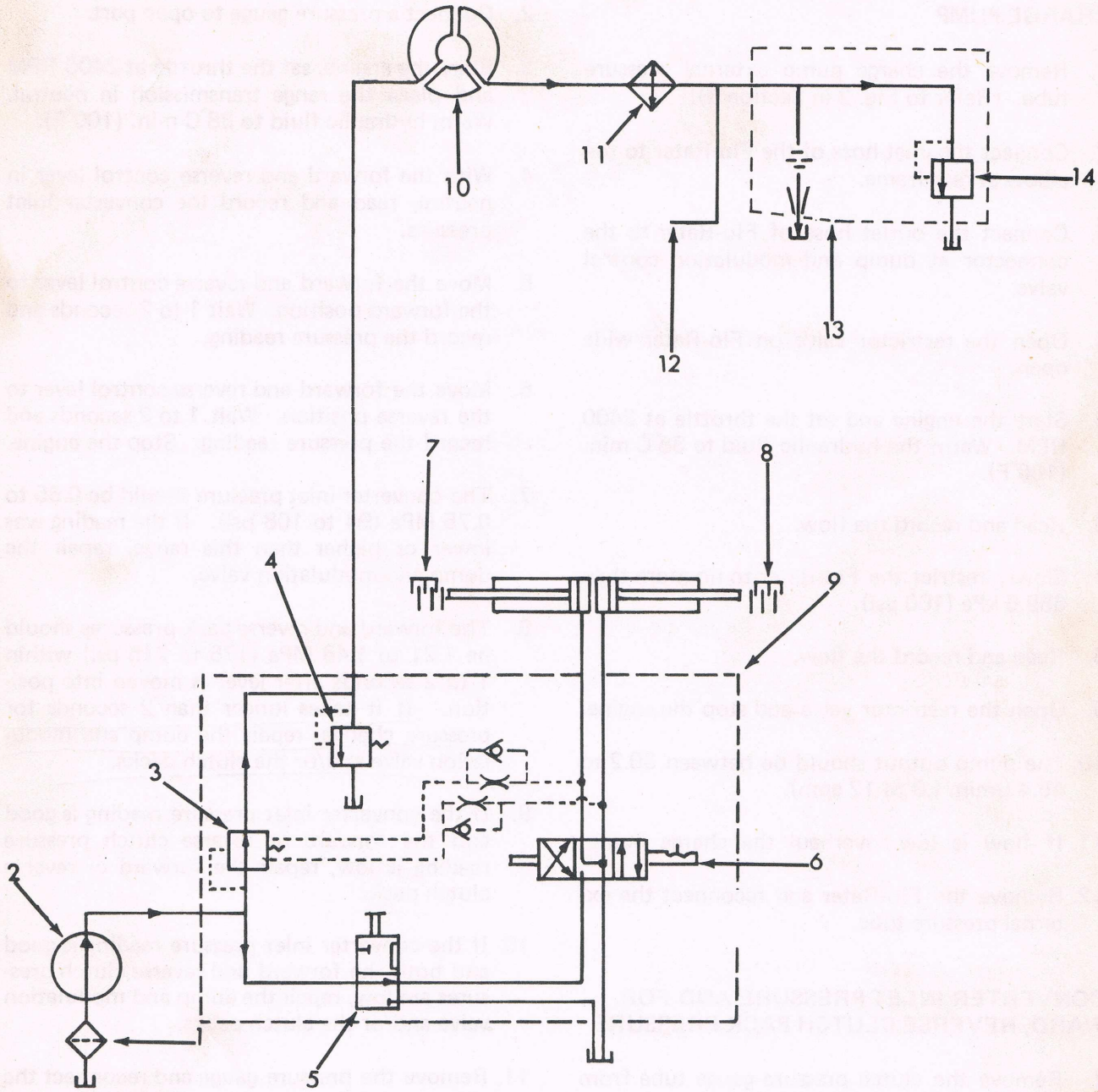


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Fig. 2
Hydraulic Circuitry (ISO Form)

1. Screen
2. Charge Pump
3. Main Regulating Valve
4. Converter Regulator Valve
5. Dump Spool
6. Directional Spool
7. Forward Clutch Pack
8. Reverse Clutch Pack
9. Dump and Modulation Control Valve
10. Torque Converter
11. Oil Cooler
12. Brake Keep Full
13. Regulator Junction Valve
14. Lube Regulator Valve

HYDRAULICS

TESTING

CHARGE PUMP

1. Remove the charge pump external pressure tube. (Refer to Fig. 2 in Section 6).
2. Connect the inlet hose of the Flo-Rater to the elbow at rear frame.
3. Connect the outlet hose of Flo-Rater to the connector at dump and modulation control valve.
4. Open the restrictor valve on Flo-Rater wide open.
5. Start the engine and set the throttle at 2400 RPM. Warm the hydraulic fluid to 38°C min. (100°F).
6. Read and record the flow.
7. Slowly restrict the Flo-Rater to no more than 689.5 kPa (100 psi).
8. Read and record the flow.
9. Open the restrictor valve and stop the engine.
10. The pump output should be between 30.2 to 45.4 l/min. (.8 to 12 gpm).
11. If flow is low, overhaul the charge pump.
12. Remove the Flo-Rater and reconnect the external pressure tube.

CONVERTER INLET PRESSURE AND FORWARD, REVERSE CLUTCH PACK PRESSURE

1. Remove the clutch pressure gauge tube from the dump and modulation valve.
2. Connect a pressure gauge to open part.
3. Start the engine, set the throttle at 2400 RPM and place the range transmission in neutral. Warm hydraulic fluid to 38°C min. (100°F).
4. With the forward and reverse control lever in neutral, read and record the converter inlet pressure.
5. Move the forward and reverse control lever to the forward position. Wait 1 to 2 seconds and record the pressure reading.
6. Move the forward and reverse control lever to the reverse position. Wait 1 to 2 seconds and record the pressure reading. Stop the engine.
7. The converter inlet pressure should be 0.65 to 0.75 MPa (94 to 108 psi). If the reading was lower or higher than this range, repair the dump and modulation valve.
8. The forward and reverse pack pressures should be 1.21 to 1.48 MPa (175 to 215 psi) within 1 to 2 seconds after lever is moved into position. If it takes longer than 2 seconds for pressure change, repair the dump and modulation valve and/or the clutch packs.
9. If the converter inlet pressure reading is good and the forward or reverse clutch pressure reading is low, repair the forward or reverse clutch pack.
10. If the converter inlet pressure reading is good and both the forward and reverse clutch pressures are low, repair the dump and modulation valve and/or the clutch packs.
11. Remove the pressure gauge and reconnect the clutch pressure gauge tube to the valve.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

World Wide Product Support

PAY LINE GROUP

Printed in United States of America

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